NOVEMBER, 1955

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

FOUNDED 1903

SERIAL RECORD
DEC 12 1955
Copy

The Structure of Electrodeposited Metals
Study of Surfaces with Electron Microscope

Finishing Pointers
Stripping of Tin from Copper-Base Alloys

Continuous Hot Galvanizing of Strip
Tight Coats by Control of Fluxing, Preheating and Alloy Formation

Electroplating on Porous Metal
Trapped Solutions and Practical Processing

Surface Treatment and Finishing of Light Metals
Anodizing with Chromic, Sulfuric and Oxalic Acids

Science for Electroplaters
Solutions

Complete Contents Page 57

WHERE PLATERS AND FINISHERS LOOK FOR INFORMATION
WESTWOOD, N. J.
FINISHING PUBLICATIONS, INC.

READ & PASS ON

A CLEPO Compound

A Soak Cleaner for the

REMOVAL OF BUFFING COMPOUNDS

from **BRASS** *Also recommended for*

ALUMINUM - COPPER - NICKEL SILVER - STEEL

CLEPO 77-B

★ Rapid and thorough in action. Does not tarnish. Brass, Copper, Etc., on prolonged soaking.

★ No dry-out stains.

★ Can be used without agitation in many cases.

★ Easily rinsed.

★ Contains no soap.

★ Can be used in any water.

Contact your Clepo Serviceman for more information or write to

CLEPO CLEANING COMPOUNDS

FREDERICK GUMM Chemical Company Inc.

538 FOREST STREET. KEARNY, N.J.

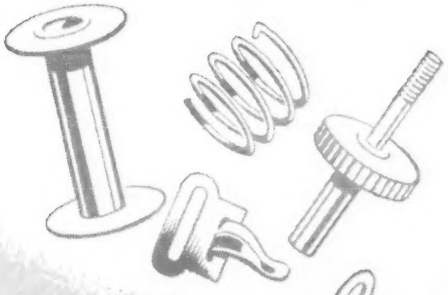
B 564190

Blacken

copper, zinc, steel

the SURE way with . . . ENTHONE

Ebonols*



Enthone, with years of experience, has accumulated a storehouse of information on the right way to blacken metals. This knowledge is always available to our customers through our Service Department.

EBONOL "S" Processes for blackening steel to produce jet-black oxide coatings. Simple and economical to operate. Operating temperatures: EBONOL "S", 285-290°F., EBONOL "S-30", 295-305°F.

EBONOL "C" The quality black for copper and brass that meets all military specifications.

EBONOL "Z" A durable, deep, rich finish for zinc plate or zinc alloy castings. Dull or glossy oxide black coatings are formed in from 5 to 10 minutes at 160-180°F.

EBONOL "Z-80" A blackening process for zinc and zinc base alloys. Operates at room temperature.

WRITE US FOR ANY NEEDED INFORMATION OR ADVICE ON ANY BLACKENING PROBLEMS

*REG. TRADEMARK

U.S. PATENT NOS. 2,364,993, 2,460,896, 2,460,898, 2,481,854.

METAL FINISHING PROCESSES

ENTHONE
INCORPORATED
442 ELM STREET
NEW HAVEN, CONNECTICUT

ELECTROPLATING CHEMICALS

Service Representatives and Stock Points in Principal Cities of U. S. A. and Canada, Mexico, Brazil, England, France, Sweden and Germany.

Do you need answers to these questions?

1. **How can I electroclean steel at lower cost?**
2. **How can I find a brass cleaner that gives better protection against tarnishing?**
3. **How can I reduce rejects due to faulty electrocleaning of zinc die castings?**

Answer 1: Following an Oakite recommendation, one plater made a small change in his steel-cleaning cycle and soon had two tankfuls of cleaning solution doing the work of three—and the plate adhesion was improved. *See booklet offered below.*

Answer 2: Oakite has a new brass cleaner that provides scientific protection against the oxygen that tarnishes brass and other copper alloys during the application of reverse current. *See booklet offered below.*

Answer 3: Oakite has an anodic conditioner that offers brighter plating of zinc die castings . . . with no anodic blackening and fewer rejects. *See booklet offered below.*

FREE For more information about the electrocleaning of steel, brass or zinc die castings, send for one or all of the booklets listed in the coupon.

OAKITE PRODUCTS, INC.
18 Rector Street, New York 6, N. Y.

Send me the free booklets I have checked below:

☐ "Four good steps toward better electroplating on steel"
☐ "What's new for electrocleaning brass and other copper alloys"
☐ "Good news about electrocleaning zinc-base die castings"

Name_____

Company_____

Address_____

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

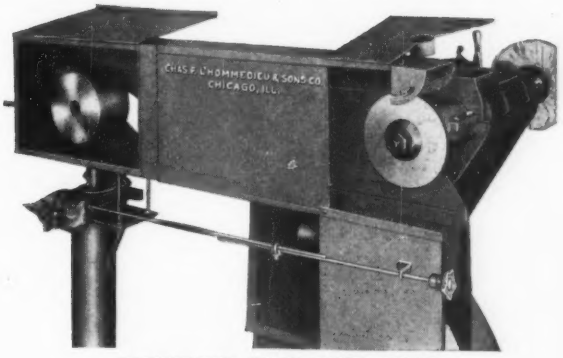
Export Division Cable Address: Oakite

Metal Finishing is published monthly by the Finishing Publications, Inc., 381 Broadway, Westwood, New Jersey, U.S.A. Entered as second class matter at the Post Office in Westwood, N. J. Volume 53, No. 11, November, 1955. Four Dollars Per Year.

USE "RELIANCE" PRODUCTS FOR

ECONOMY : EFFICIENCY : DEPENDABILITY

WRITE FOR FURTHER DETAILS

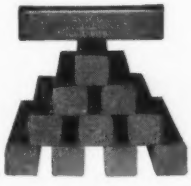


BACKSTAND IDLER WITH LATHE

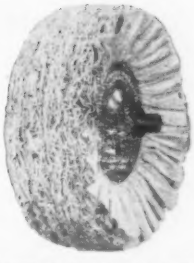
OBLIQUE
TUMBLING BARREL

#23A
POLISHING LATHE

BACKSTAND IDLER



EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"



NUWAY BUFFS FOR
FAST CUTTING

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

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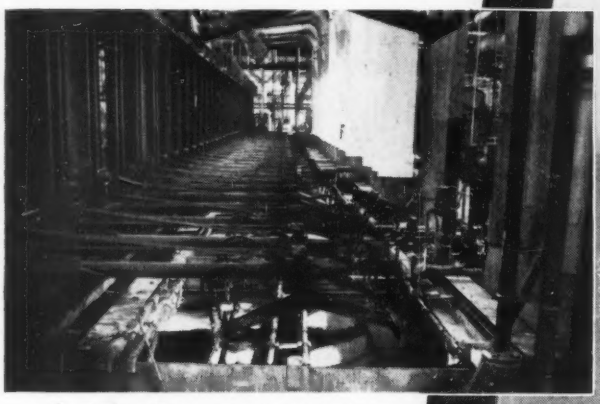
Cleveland
and
Los Angeles

Tank being sprayed with Coating 5300 by Kaybar, Inc., Hazel Park, Michigan.



Coating 5300 was specified for this line of tanks in big automotive plating plant.

spraying

with Unichrome Coating 5300

gives sheet-like coatings

Extraordinary, heavy duty plastisol protects against chemicals and corrosion

You can now take better advantage of the remarkable protection in plastisols. You can *spray*-apply what amounts to a *sheet* material.

In one coat, thermoplastic Unichrome Coating 5300 builds a pore-free film up to 20 mils thick . . . 5 to 20 times the thickness of an ordinary coating. Multiple coats can therefore do many of the jobs for which plastic and rubber sheet materials are generally used. Moreover, you get a superior job. There are no seams or joints with Coating 5300.

Coating 5300 also helps cut costs. One automotive plant coated a whole line of electrocleaning and rinse tanks, outside and inside, for less than the cost to do just interiors with plastic sheets.

This plastisol applies easily to tanks, ducts, drainboards and other equipment. It cures at 350° to 365° F. Coating 5300 won't chip and has high insulation value and exceptional toughness. It withstands all plating and cleaning solutions.

Nearby firms specializing in applying Coating 5300 can do it for you reasonably. It will also pay you to specify Coating 5300 on any *new* equipment you buy. Send for more information.

UNICHROME® **COATINGS FOR METALS**

UNITED CHROMIUM DIVISION
METAL & THERMIT CORPORATION

100 East 42nd Street, New York 17, N. Y.
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USE THIS CHECKING LIST TO PROVE

BLACOSOLV®

SUPERIORITY

✓ BRIGHTER CLEANING

★ Pure Solvent Action
★ Rapid Removal of Grease and Oil
★ No Chemical Side-Effects
★ No Etching or Blemishes on Most Delicate of Surfaces

✓ ECONOMY

★ Fewer Work Interruptions—Fewer Cleanouts
★ Less Down-time for Stoppage
★ Fewer Rejects—Less Staining and Etching

✓ VERSATILITY

★ One Solvent For All Metals
★ Cleans Alloys or Any Combination of Metals
★ Cleans "Hard to Get At" Crevices and Bores

✓ STABILITY

★ Permanent, Non-Alkalized Stabilizers
★ Resistant to Heat and Light
★ Resistant to Action of Aluminum and Acids

Write for Complete information on Blacosolv Degreasing Solvent and Blakeslee Degreasers.

G. S. BLAKESLEE & CO. 1844 S. Laramie Ave., Chicago 50, Ill.
NEW YORK • LOS ANGELES • TORONTO
also Manufacturers of Blakeslee Metal Washing and Surface Treatment Machines

DON'T MISS THE BOAT!

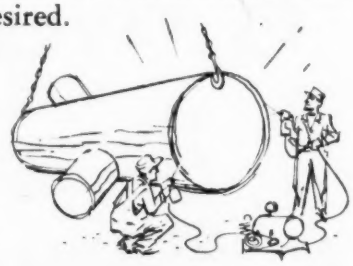
MICCROSOL SPRAY S-2003 IS READY . . . to show YOU the way to profitable spray jobs

You can apply S-2003 with conventional spray equipment.

You can apply 60 mils thickness in one application without sagging of material. If multiple coats are required, a short cure time is all that's needed between applications. A contrasting color can serve for layer identification, if desired.

Tanks
Ducts
and other
Equipment

You can use S-2003 in all plating baths. It has the same toughness—chemical, corrosion, and abrasion resistance as Miccrosol E-1003. Our adhesive systems provide outstanding adhesion to metal surfaces.



Solvent additives are not necessary. S-2003 is 100% solids and is sprayed as received. Time consuming and expensive adjustments are unnecessary. Problems of material instability and film cracking are eliminated. There is no solvent loss and less operator fatigue with Miccrosol Spray S-2003.

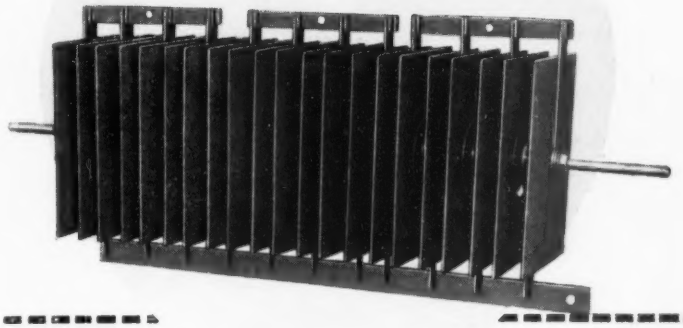
It's the ideal plastisol for spray applications.

Developed and manufactured by experienced platers

• *WRITE FOR PARTICULARS ON COMPANY LETTERHEAD*

MICHIGAN CHROME *and Chemical Company*

8615 Grinnell Avenue • Detroit 13, Michigan



Six Square Inches per Ampere* of "Heart"!

The selenium stack is the heart of any selenium rectifier. For it is the quality of the stack and its accompanying circuitry that determines the effectiveness of a rectifier, just as the state of the heart and blood vessels of a human determine his strength and health.

IT'S A PROVEN FACT, RAPID RECTIFIER STACKS STAND UP LONGER IN HARD SERVICE. HERE'S WHY:

1) Rapid allows 6 square inches per ampere of plate surface in full wave bridge circuits. For years we have maintained this standard (somewhat higher than other makes), since we feel allowing this much area results in maximum life expectancy.
2) The plates in Rapid stacks use triple purified Selenium.
3) They are carefully tested and balanced for even current distribution.
4) They are coated with an exclusive material rendering them absolutely impervious to the corrosive conditions existing in plating rooms.
5) The plates are spaced an average of ½ inch, diminishing the possibility of dust, dirt and corrosive material becoming lodged between plates, thus allowing heat to dissipate readily.

Rapid designs its stacks to much higher standards than most other manufacturers.**

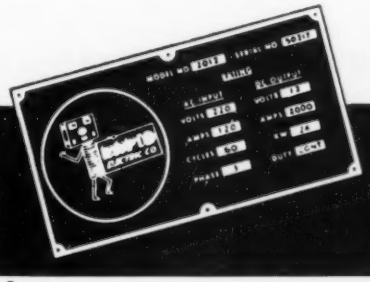
For example:

In tests performed at ambient temperatures of over 30°C, a recognized electrical manufacturers' group standard allows a temperature rise in the stack of 60°C; and, a rise of 40°C at the same ambient temperature for 1000 hours is permitted without derating.

Rapid standards permit a maximum stack temperature rise of only 22°C above the ambient. This low rise is made possible only because of the large area used per ampere, the plate spacing, high purity of Selenium used, the advanced circuitry and the engineering skill which designs the complete rectifier unit for the specific job.

So, when you buy a rectifier, check its heart. Make sure the one you buy offers the most advanced design for longest life . . . In other words, make sure you get a Rapid Rectifier.

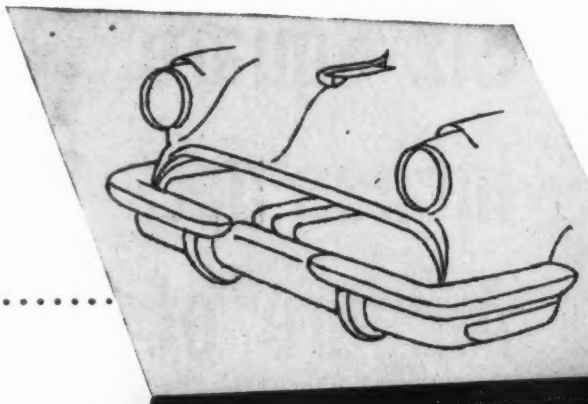
*In forced air cooled, three phase, full wave bridge circuit units.
**All three phase rectifiers are designed with a full wave circuit.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

2881 Middletown Road • New York 61, N. Y. • Phone: Talmadge 8-2200



HARSHAW electroplating CHEMICALS and ANODES

nickel plating

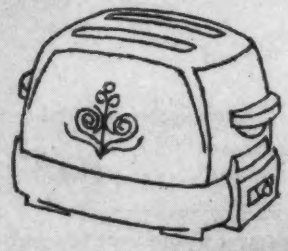
... still and barrel ... nickel anodes—all commercial grades and sizes ... anode bags ... single nickel salts—nickel chloride ... nickel carbonate ... nickel fluoborate ... boric acid.

chromium plating

... pure "Krome Flake" 99.8% CrO_3 ... sulphates less than .10% ... lead, tin-lead and antimony-lead anodes.

copper plating

... copper ball anodes ... Rochelle Salts ... sodium and copper cyanides ... copper sulfate ... copper fluoborate.

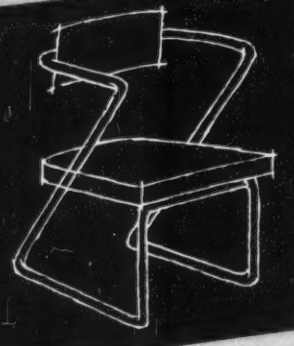


cadmium plating

... ball and cast cadmium anodes ... cadmium oxide ... sodium cyanide ... cadmium fluoborate.

tin plating

... cast tin anodes ... sodium stannate ... stannous sulfate ... tin fluoborate ... acid tin addition agent.

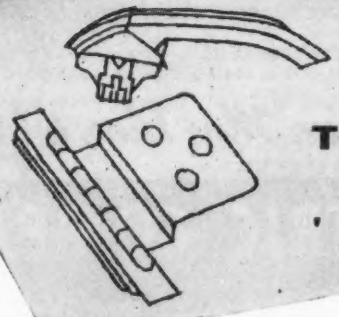


zinc plating

... ball and cast zinc anodes ... sodium and zinc cyanide ... zinc sulfate ... zinc fluoborate.

lead plating

... cast lead anodes ... lead fluoborate.



silver plating

... silver cyanide.

THE HARSHAW CHEMICAL COMPANY

Cleveland 6, Ohio

Chicago 10, Ill. • Cincinnati 13, Ohio • Detroit 28, Mich.
Houston 11, Texas • Los Angeles 22, Calif. • Philadelphia 48, Pa.
Pittsburgh 22, Pa. • New York 17, N. Y.

Another Outstanding Achievement

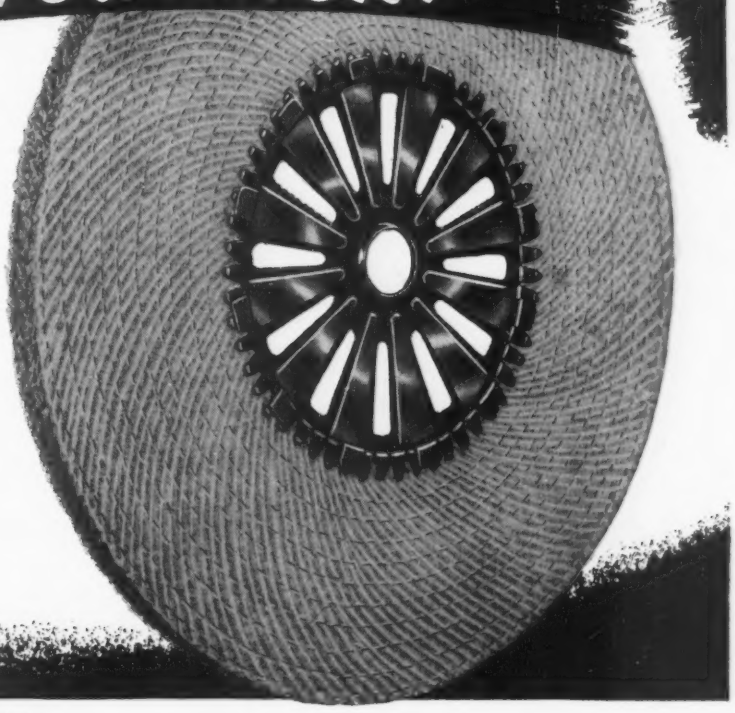
by AMERICAN BUFF

Exclusive *NEW*

"Golden Treatment"

on

SISAL BUFFS



SPEEDS BUFFING...CUTS COSTS
in all these ways!

STRENGTHENS SISAL FIBRES
to resist fraying and give *longer wear*

BINDS FIBRES TOGETHER
for firmer body, permits *faster cutting* ... fewer passes

HOLDS MORE COMPOUND
provides better buffing action with *less waste*

SISAL—the No. 1 buffing material—is now *better than ever* through our revolutionary new "golden treatment!" This amazing process *acts two ways* to improve the buffing quality of Sisal:

FIRST, it *overcomes* Sisal's resistance to oil and water, helps fibres hold buffing compound better.

SECOND, it gives the buff *firmer body*, without extra stiffness.

The result of four years of research, the new "Golden Treatment" is *your* golden opportunity for faster production, better work, and increased savings. *Ask for a demonstration in your own plant!*

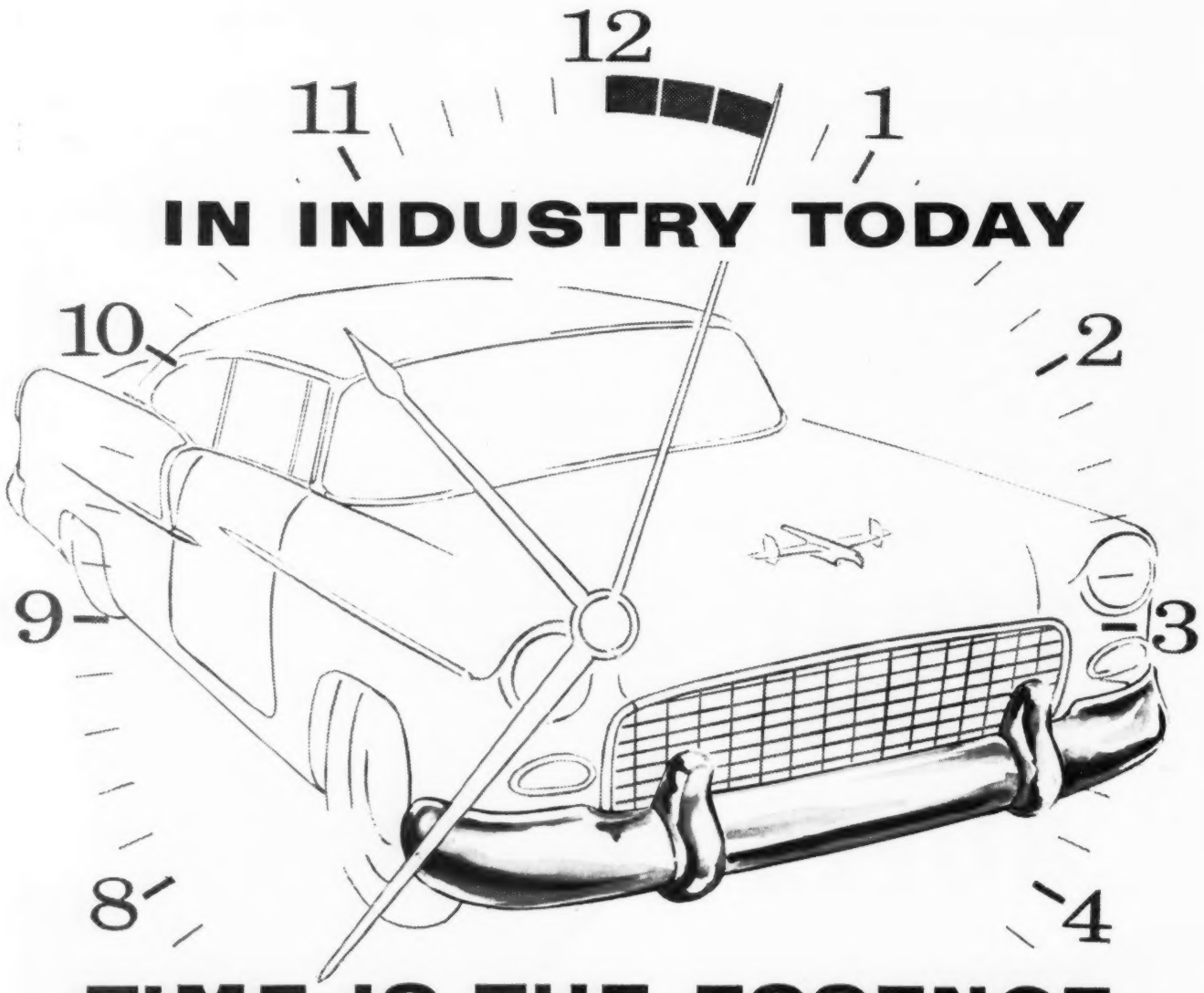
Available on all American Sisal Buffs: Centerless . . . Permanent Center . . . or Conventional Type Sisal, as well as on Cotton Buffs.

"For the Job That's TOUGH, Use an AMERICAN BUFF"

AUTOMATIC BUFF CO. DIVISION OF

American Buff Company

2414 S. LaSalle St. • Chicago 16, Illinois • Telephone: CAlumet 5-1607



IN INDUSTRY TODAY

TIME IS THE ESSENCE

An automobile bumper chromium-plated every three seconds! This is the rate at one plant where 170,000 square feet of metal are plated daily.

Production of that sort can be maintained only when raw material suppliers have ample capacity and adequate stocks to insure prompt shipment.

Chromium platers who obtain their chromic acid from Mutual are not only assured of receiving a top-quality product, but also careful compliance with their delivery schedule.

CHROMIC ACID

•

SODIUM BICHROMATE

•

POTASSIUM BICHROMATE

MUTUAL CHEMICAL DIVISION

MUTUAL

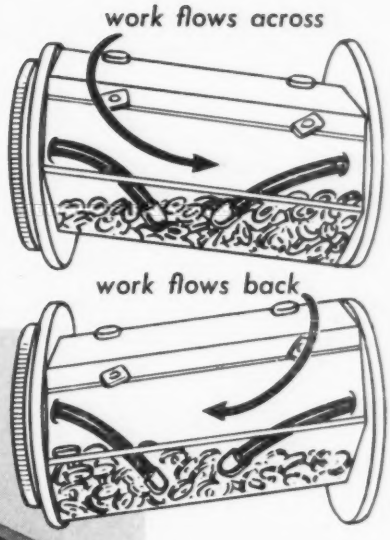
ALLIED CHEMICAL & DYE CORPORATION

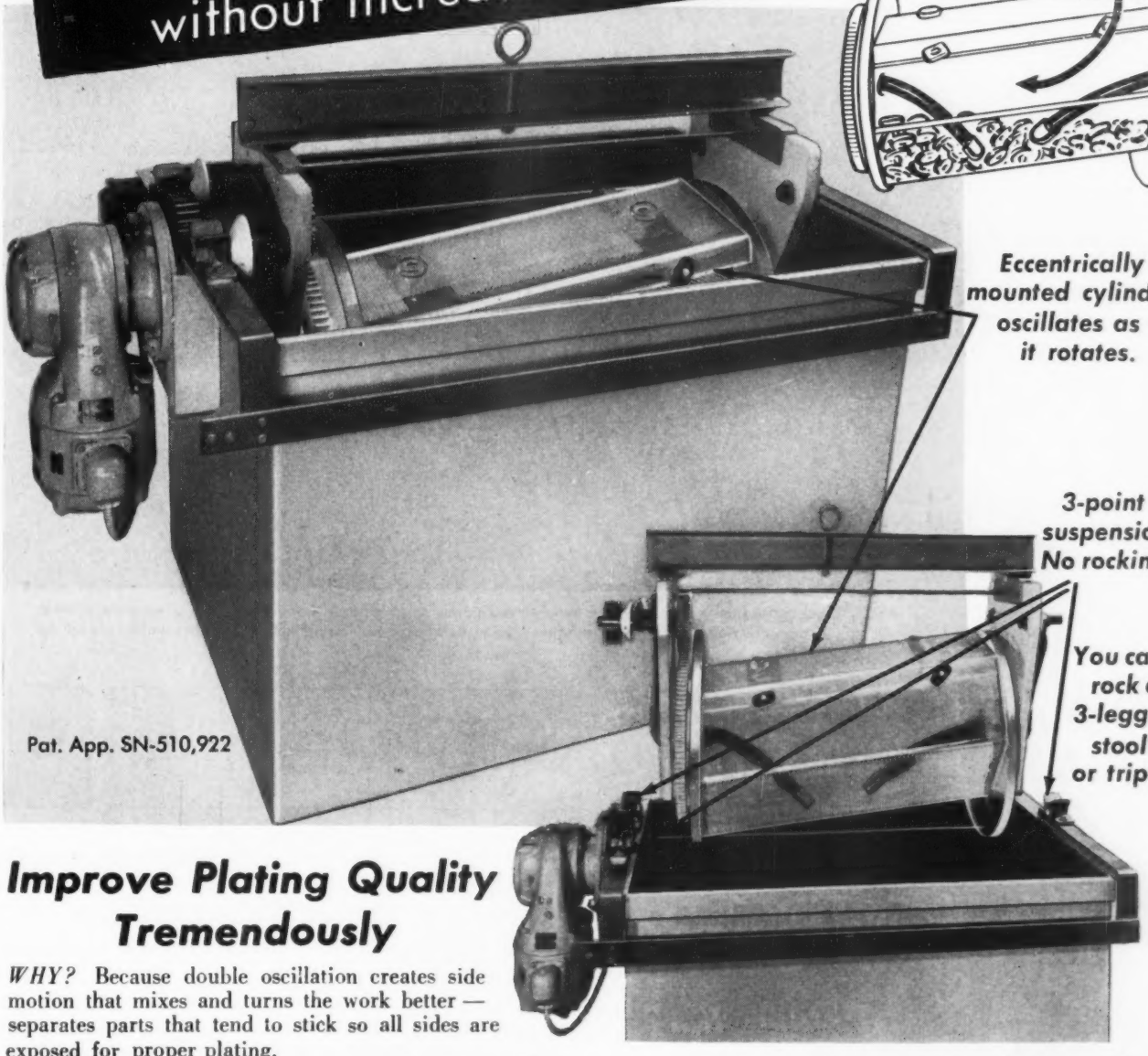
99 PARK AVENUE • NEW YORK 16, N. Y.

Allied Chemical

BELKE DOUBLE OSCILLATING Plating Cylinders

Increase mixing action without increase in speed.




Eccentrically mounted cylinder oscillates as it rotates.
3-point suspension No rocking
You can't rock a 3-legged stool or tripod.
Pat. App. SN-510,922

Improve Plating Quality Tremendously

WHY? Because double oscillation creates side motion that mixes and turns the work better — separates parts that tend to stick so all sides are exposed for proper plating.

A specified thickness is obtained quicker with no over-plating or underplating.

WHY? Because the work moves back and forth across the cylinder. None remains shielded by the cylinder ends as happens with conventional barrels. Consequently all work is equally exposed and receives equal deposit. It is not necessary to over-plate some of the work in order to adequately plate the rest.

You can replace present cylinders with BELKE Double Oscillating Cylinders.

BELKE Double Oscillating Cylinders are made in all sizes from 14x30 regulars to 6x12 portables.

They are available as replacements for present cylinders or as complete plating units.

They can be furnished with BELKE non-rocking 3-point suspension as illustrated or with conventional 4-point suspension.

Double oscillation soon pays for new cylinders by saving in time and materials. Order a BELKE Double Oscillating Cylinder and see the big difference.

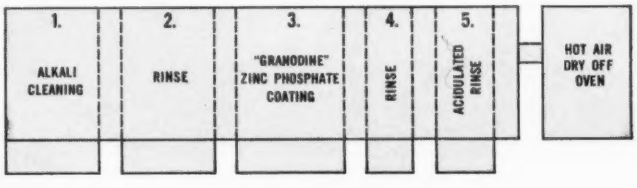
Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51
EVERYTHING FOR PLATING PLANTS

GRANODIZING PROCESS PRODUCES STEEL DRUMS FREE OF GREASE, DIRT, SCALE—AND RUST INHIBITED

Photo courtesy United States Steel Products Division, U.S. Steel Corp., Camden, N.J.

TREATMENT OF UNASSEMBLED SHELL, head and bottom drum sections is done in this power spray washer. Conveyer carries drum parts through five cleaning, rinsing and phosphate-coating stages. Drying oven removes moisture from parts prior to painting. Finish is durable and better looking.

5-stage process uses Granodine® to provide better paint adherence and underfinish rust resistance



1-YEAR EXPOSURE TO WEATHER proves the effectiveness of the phosphate coating. Untreated drum at right is rusted and pitted. Phosphate-coated drum at left has retained its finish. Coating provides a firm, durable bond for paint, retards corrosion.

In the Granodizing process, drums fabricated from steel are both freed from grease, oil and dirt and protected by a rust-inhibiting nonmetallic crystalline zinc phosphate coating over the entire inner and outer surfaces. Residues and contaminants are completely removed to assure high product purity.

Cleaning and phosphate-coating operations are done in a large high-speed power spray washer. Continuous spray phosphatizing machines such as this are used where large quantities of similar products are treated. Since Granodizing is effective only on greasefree surfaces, such machines must provide the steps necessary to remove all impurities. This is done by passing the work through five cleaning and rinsing stages.

The process as developed is another example of the technical assistance which ACP offers its customers. Our Engineering and Service Departments not only recommend the proper equipment, but instruct plant personnel in its operation, and check samples of the finished product in our own Quality Control Laboratory.

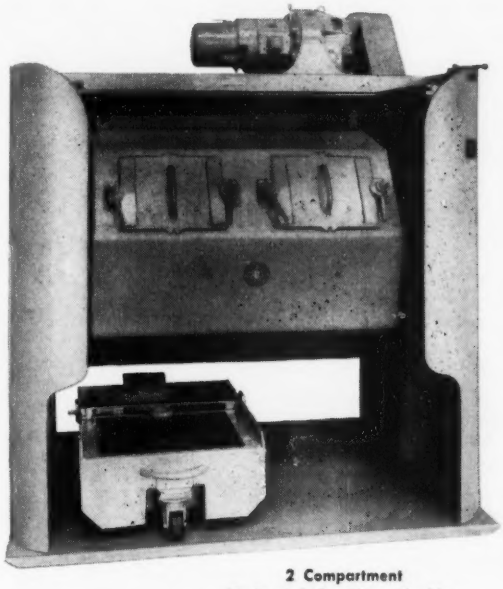
May we help you? Write or call us for complete information about Granodizing with Granodine.

AMERICAN CHEMICAL PAINT COMPANY, Ambler 13, Pa.

DETROIT, MICHIGAN NILES, CALIFORNIA WINDSOR, ONTARIO

CHEMICALS ACP PROCESSES

CROWN TUMBLE
DEBURRING EQUIPMENT

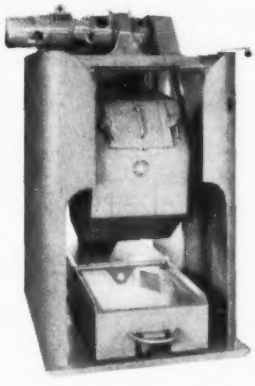


2 Compartment
Horizontal Tumbling Machine

To deburr and tumble finish metal parts

Crown's complete line of newly improved tumbling machines and labor saving accessories provide huge savings in time-costs and labor.

- Light weight — quick acting "seal tite" doors with easily replaceable gasket.
- Front safety guard.
- Forward and reverse switch to rock barrel in rinsing and to position doors for loading and unloading.
- Easily accessible motor and bearings.
- Rubber lined — Neoprene lined — unlined.
- Special machines designed and built

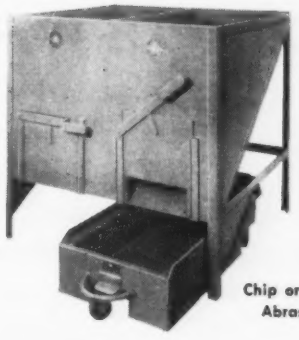


Single Compartment
Horizontal Tumbling Machine

Mechanical Separating Table
Hoist Pan Type

Separating Table
Hand Type

Separator — Motor Drive
with Hopper



Chip or Tumbling
Abrasive Bin

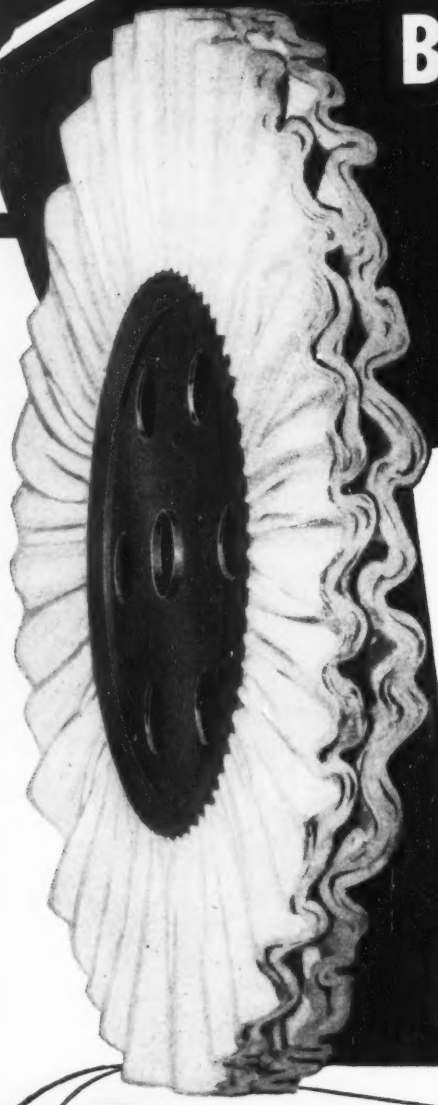
WRITE FOR OUR COMPLETE CATALOG OF TUMBLING MACHINES AND ACCESSORY EQUIPMENT

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

New SCHAFFNER BIAS buffs

give more mileage . . .



because

. . . FULLY VENTILATED
. . . COOLER RUNNING
LOW COMPOUND CONSUMPTION
. . . FEWER SECTIONS NEEDED
. . . GIVES LONGER LIFE
. . . LATHE FACED AND BALANCED

Manufactured and controlled in our own new modern up-to-date Buff plant. Can be tailor made for your toughest buffing problem

MADE BY THE MANUFACTURERS OF FAMOUS AND ACCEPTED SCHAFFNER NO NUBBIN BUFFING COMPOSITIONS.

"Schaffner Bros. make things shine"
Bob — Paul — Gus

Schaffner
manufacturing company, inc.
SCHAFFNER CENTER • EMSWORTH, PITTSBURGH 2, PA.

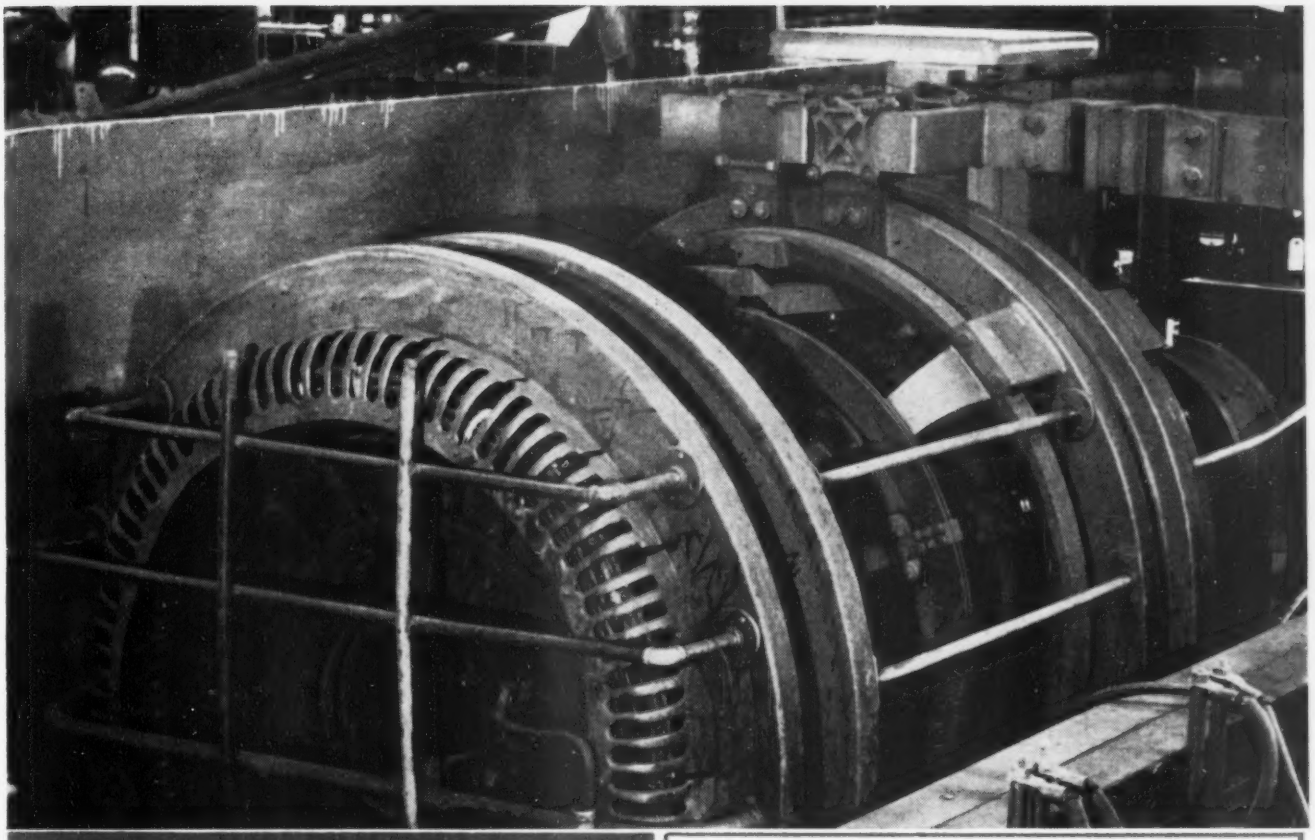
CLIP TO YOUR LETTERHEAD

Phone ROsewood 1-9902

Please send me catalogue and complete information:

NOW PRESENTLY USING _____ Name, Manufacturer and Code No. of Buff _____
DIAMETER _____ CENTER SIZE _____
CENTER SIZE _____ ARBOR _____
PLY _____ COUNT _____
NORMALLY I USE _____ SECTIONS PER MONTH _____
NAME _____ TITLE _____
COMPANY _____ STREET _____
CITY _____ ZONE _____ STATE _____

SCHAFFNER AIR-COOLED METAL-CENTER BUFFS ARE PRICED RIGHT • PRODUCED IN ALL DIAMETERS, CENTERS, PLYS AND COUNTS



INDUSTRY LEADERS CHOOSE

Chandeysson

ELECTROLYTIC GENERATORS

Example:

BECKER ELECTROTYPE COMPANY depends on this 5000 ampere, 9 volt, Chandeysson Motor Generator for power in normal operation... and in rush-hour emergencies, as well.

THE AMAZING STAMINA of Chandeysson Motor Generators in standing up under emergency overloads ... without damage of any sort ... is a result of engineering that insists on an ample margin of safety. The power supply is always there when you need it.

YOU SAVE 4 WAYS WITH Chandeysson GENERATORS

Use Less Power ... precision-built for efficiency and built-in voltage regulation.

Be Sure of Power When You Need It Most ... overload capacity as great as 50% momentarily and 25% sustained, without distress or damage.

Get More Out of the Power You Pay for ... built-in high power factor at no extra cost.

Enjoy Lifetime Power Dividends ... sustained, lifetime overall constant efficiency as high as 85% does not decrease with age or overload.

For product information write for bulletins D-101 and D-102—for names of users and installation data ask for bulletin D-104.

CHANDEYSSON ELECTRIC COMPANY • 4074 **Bingham Ave., St. Louis 16, Missouri**

THE NAME THAT STANDS OUT IN BLACK OXIDE FINISHES

Type A Blackening Process For Steel

Improves Your Product
Increases Production
Cuts Costs

TROUBLE-FREE • ECONOMICAL • ATTRACTIVE

- One Bath -- One Salt
- Lower Operating Temperature
- Self Rectifying
- Faster Blackening Cycle
- More Corrosion Resistant

Also Black Magic Blackening Processes for other ferrous and non-ferrous metals; metal cleaners, rustproofing oils and waxes, plating specialties and a complete line of heat treating salts.

Mitchell-Bradford

THE MITCHELL-BRADFORD CHEMICAL CO.

Wampus Lane Milford, Conn.

QUALITY PRODUCTS OF CHEMICAL RESEARCH

STEVENS *Slants* ON METAL FINISHING

"FROM THE CASTING OR STAMPING TO THE FINAL FINISH"

PLYMOUTH

1956 Plymouth Belvedere Four-Door Sedan

PUTS THE *FORWARD LOOK* IN METAL FINISHING

In the Plymouth Division's all new multi-million-dollar V-8 engine plant, where new concepts of quality control and manufacture have been incorporated, a Frederic B. Stevens, Inc., automatic "Little Steve" machine has been installed for tin immersion plating of pistons.

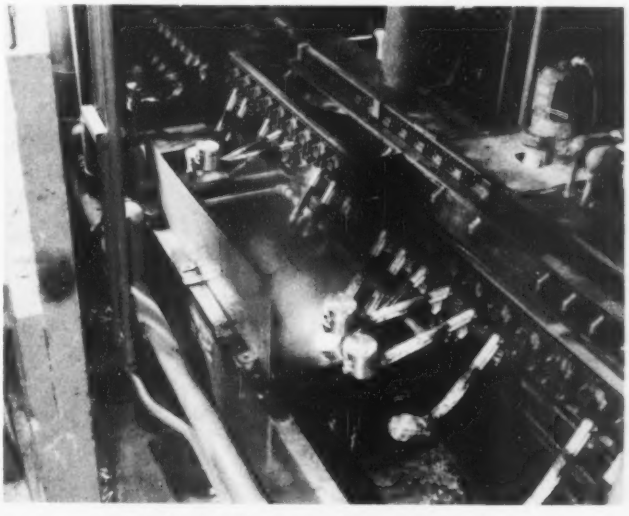
Plymouth's "Little Steve" is also equipped with automatic load and unload devices and can easily handle the production requirements of 1,600 pistons per hour. In fact, the Plymouth machine has been designed so that additional arms can be added at any time to increase the production rate.

"Little Steve" Pays Off

"Little Steve" is a recent development of Frederic B. Stevens, Inc. It is a space-saving, low-cost automatic plating and/or immersion processing machine using arms (as shown in the Plymouth installation) or racks which are placed on the arms. When racks of small parts are used it is capable of processing or plating up to 40,000 pieces per eight hour day.

The size of the "Little Steve" makes for easy installation in most plants. It offers no floor overload or ceiling height problems. Furthermore, it fits in most factory bays between structural members. Small over-all size and smaller tank size means low solution expense. The capital investment is low, too – low enough to enable many companies to now have their own automatic installation.

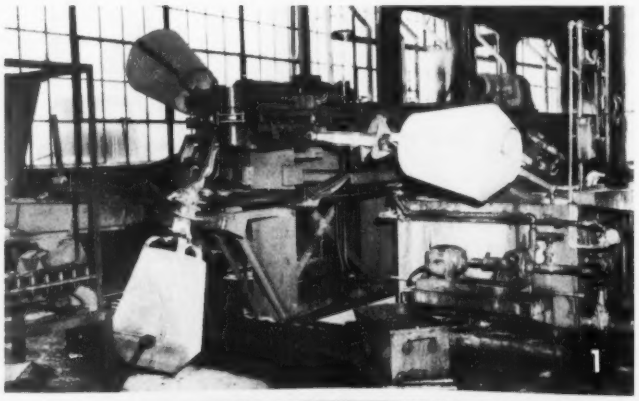
If you would like further information about "Little Steve" write today to Frederic B. Stevens, Inc., Detroit 16, Michigan, or call your local Stevens Sales Engineer.



"Little Steve" automatic machine for immersion tin plating at the new Plymouth V-8 engine plant.

STEVENS *Slants* ON METAL FINISHING

STEVENS CONTRIBUTES TO THE *"FORWARD LOOK"* EXPANSION PROGRAM AT CHRYSLER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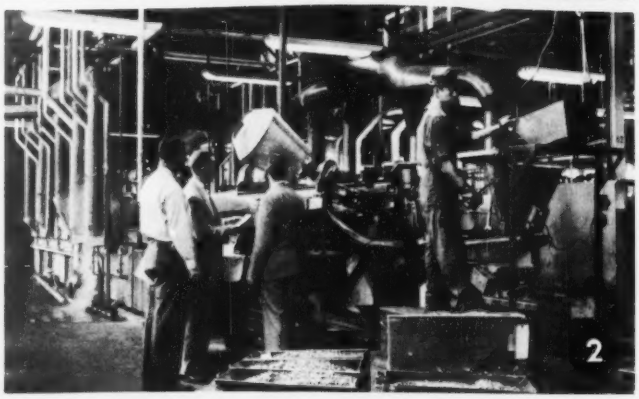
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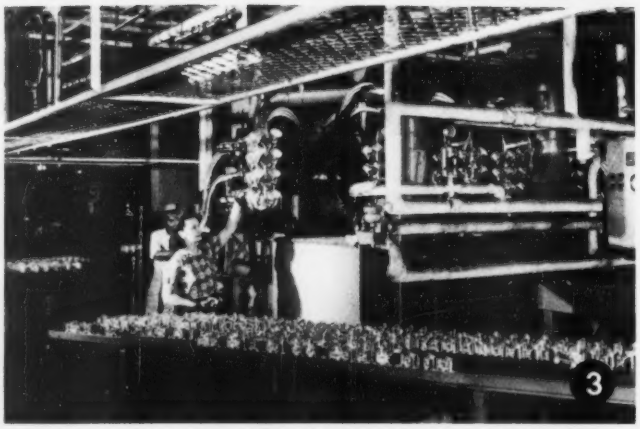
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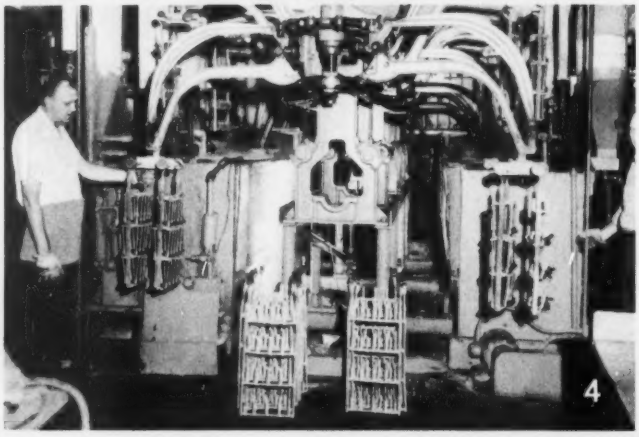
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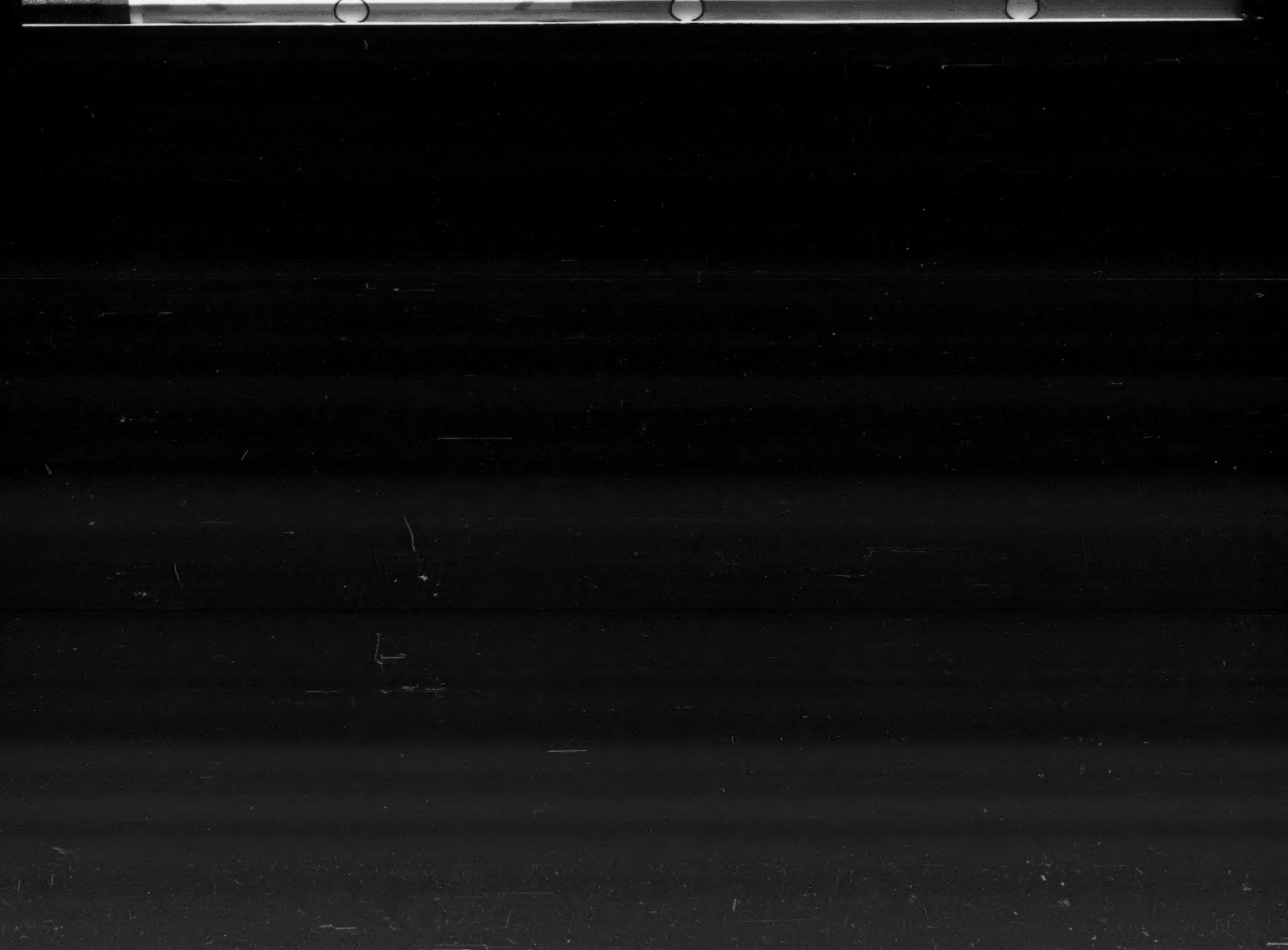
In the modernized and new Chrysler Corporation plants in and around Detroit, Michigan, many Stevens automatic metal finishing machines and still tank lines are helping to maintain Chrysler's stepped-up production along with even higher standards of quality.

These Stevens installations are used for a variety of purposes. At the Chrysler Highland Park, Michigan, plant a Stevens Super "E" Automatic Barrel machine (illustration No. 1) is used for phosphating of small engine and chassis parts. At the Chrysler Jefferson plant in Detroit a Stevens Model "C" Automatic Barrel Plating machine (illustration No. 2) is used for zinc plating. The big Dodge Main plant has in operation a Stevens Model "B" machine (illustration No. 3) for tin coating of Dodge pistons, while still another Model "B" Automatic is in use at Dodge Main (illustration No. 4) for the rustproofing of engine and drive parts.

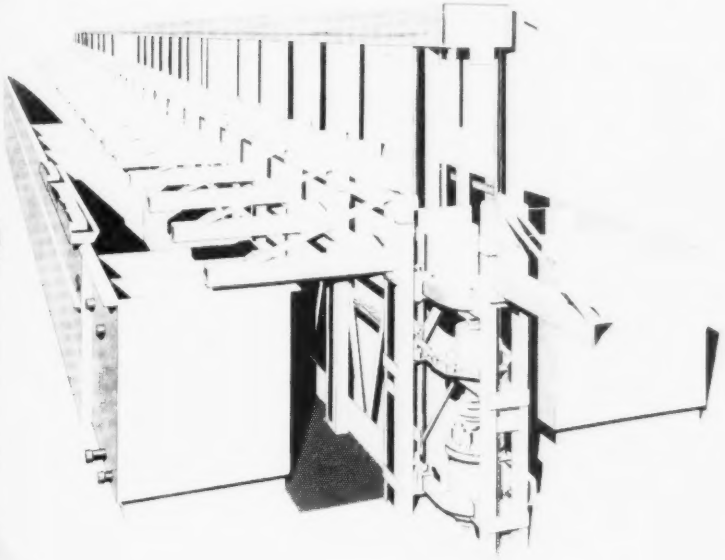
Chrysler Corporation also has installed Stevens metal finishing and processing equipment in the Evansville, Indiana, factory; in the big plant at Windsor, Ontario; and at the Tank Arsenal. There are numerous still tank installations at the various factory facilities, including one for specialized plating of jet engine parts at Warren, Michigan.

Your metal finishing requirements may call for numerous processes like Chrysler's or others such as nickel, chrome and copper plate, bright dipping, pickling or anodizing as well as polishing or buffing. Whatever your needs, Stevens has the complete line of equipment to meet those needs. We will recommend the right equipment for the job, and engineer and build the complete package. There is no need to shop around for special items of equipment.



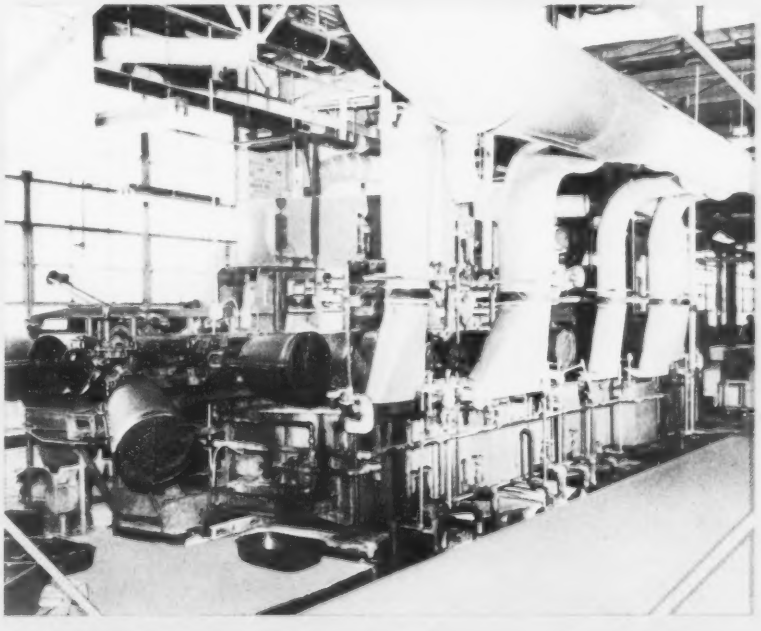
STEVENS Slants ON METAL FINISHING

A page from the
STEVENS SCRAPBOOK
First complete family of Automatic Plating and Processing machines.



Perspective drawing of a typical "Stevadoer" featuring adaptable load capacity, mechanical flexibility and high lift. It can be truly said that the "Stevadoer" meets tomorrow's combined safety and production requirements. Although on the market less than a year, nine different processes have already been adapted to this versatile unit. The most popular have been anodizing, paint preparation, rustproofing and copper-nickel-chrome, and zinc electroplating.

"Stevadoer" himself—symbol of the Stevens machine bearing his name. First advertised to the metal finishing industry in January 1955, it has become a phenomenal success. In less than one year over $2,000,000 in "Stevadoer" orders have been placed representing a total rack traveling distance of nearly one-half mile.



Stevens Automatic Barrel Processing Machine installation at Motorola, Inc., used for copper plating small parts. No lids, no covers, no clamps, that's the story behind every Stevens Automatic Barrel unit. In addition there is no operating mechanism submerged in any solution and no corrosion problems since the unit is easily ventilated. Furthermore no auxiliary dryer or transfer unit is required. Note: Complete dryer (either gas or steam heated) is installed as an integral part of the Stevens unit.

STEVENS Slants ON METAL FINISHING

TIPS AND TATTLE

The trend is definitely up in the use of aluminum in the 1956 model cars. And there is much more planned for 1957. Grilles, hub caps and instrument panel units are being anodized, then dyed. A colorful effect is the result. We're happy to say that Stevens automatic machines are being used for this work in the majority of the automobile plants. If you are interested in anodizing, plating, or buffing and polishing of aluminum we can help you. The Stevens staff has years of experience which is yours for the asking.

• • •

The trade press has featured several articles in recent months on subjects that are of interest to those in the metal finishing industry.

"In-Plant Plating Moves Diversified Product Line Faster!" – Stevens automatic barrel plating installation at Unistrut Corporation cuts down a 5 to 7 day minimum delivery time to a few hours – *The Iron Age.*

"You Can Cut Your Plating Costs!" with the proper waste disposal system – *Factory Management* and *Maintenance.*

"Bright Dip Line For Aluminum and Brass" – now even the small operator can profit from machine dipping – *Steel.*

Reprints of a few of these and other related articles are available to you from your Stevens Sales Engineer or home office.

• • •

Water pollution and shortages are increasing year after year and water conservation is becoming a national problem. Industry as well as the government is taking a hand in corrective measures. In rinse water alone shops and plants doing electroplating use millions of gallons per year. There are ways of using these rinse waters over and over with waste disposal and other systems. Stevens has been in the thick of this problem, as it applies to metal finishing, for several years. We will be glad to be of help to you.

• • •

One of the hottest tips we have been able to pass on for some time is the report of a large manufacturer of brass and bronze plumbing supplies. They have at least *doubled* the life of their polishing belts by using Stevens Belt Grease. In addition to this saving they have discovered that by cleaning their belts, at regular intervals, in a suitable solvent, the Stevens Belt Grease comes off and carries the metal particles with it. This operation removes the "glaze," restores the belt to its original condition, and the belt is ready for a second application of Belt Grease and continued use. This cleaning operation and lubrication extends total belt life approximately *four times.*

• • •

You may benefit from this experience we picked up not so long ago regarding degreasing units. In placing the degreasing unit in your plant be sure it is protected from strong cross-drafts. In a strong cross-draft, material will be wasted through excessive evaporation, and the vapors may drift to other sections of the plant.

THE FINISHING TOUCH

PRECISION FINISHING METHODS

by D. J. Swaninger
Sales Manager—
Stevens Compositions

Stevens experience and experimental work for customers with jobs calling for micro-inch surface specifications, edges with exact radii and surfaces prepared for minimum thickness limits, has shown that there is usually a method or product that does it better.

Sisal Buff Polishing—Where fast cutting action and blending of polishing lines is required on steel surfaces prior to plating, use a Sisal Buff along with Stevens #414 Steel Compound in bar form or Stevens #3-L

Liquid Compound. They provide the cutting action and prolong the life of the wheel.

Tampico Brushing—Maximum flexibility for difficult contours such as deburring precision gears and other operating parts. Longer life and faster cutting action is provided when used with Stevens Emery Paste and special Tampico compounds.

Cloth Buff Deburring and Polishing—Available in a wide variety of types, are used with Stevens greaseless compositions for the finest satin finishing operations, also for polishing and deburring critical edges and areas.

Cloth Buff Coloring—For coloring copper-plated surfaces having a thin deposit, where nickel-chrome is to be deposited directly on the copper—Stevens White Rose Lime Composition brings up a beautiful luster with minimum removal of plated metal. It flows the copper without cutting through.

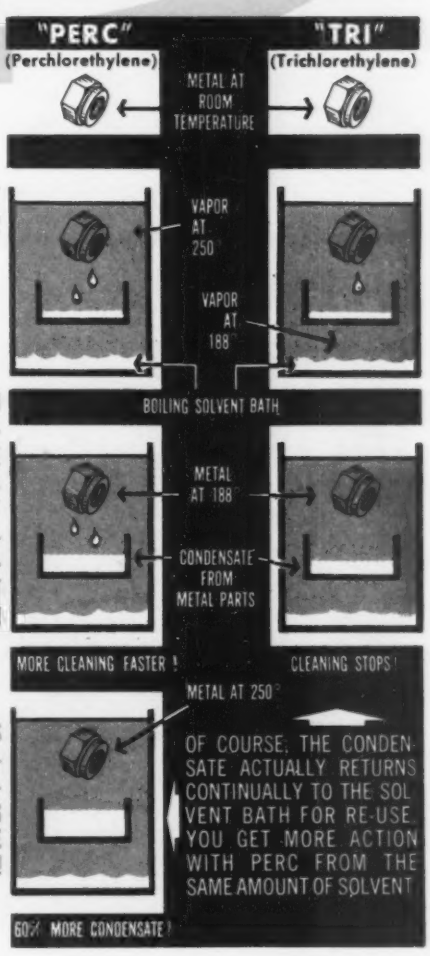
We are always at your service in solving polishing and buffing problems. Write today.

FREDERIC B.
STEVENS
INCORPORATED
YOUR METAL FINISHING SUPERMARKET

DO YOU KNOW

the advantages in VAPOR DEGREASING with PERCHLOROETHYLENE ?

REGARDLESS OF THE TYPE, SHAPE, OR QUANTITY OF METAL BEING DEGREASED...


"PERC"
(Perchlorethylene)
"TRI"
(Trichlorethylene)
METAL AT ROOM TEMPERATURE
VAPOR AT 250°
VAPOR AT 188°
BOILING SOLVENT BATH
METAL AT 188°
CONDENSATE FROM METAL PARTS
MORE CLEANING FASTER !
CLEANING STOPS !
METAL AT 250°
OF COURSE, THE CONDENSATE ACTUALLY RETURNS CONTINUALLY TO THE SOLVENT BATH FOR RE-USE. YOU GET MORE ACTION WITH PERC FROM THE SAME AMOUNT OF SOLVENT
60% MORE CONDENSATE !

... **PERC** VAPOR WILL START TO CONDENSE AT A FASTER RATE THAN TRI ...

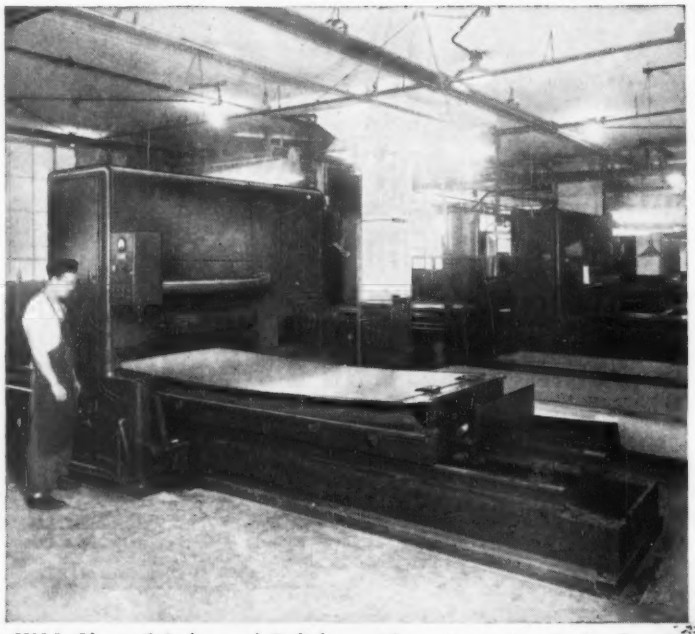
... AND WHEN THE METAL IN TRI HAS REACHED THE MAXIMUM VAPOR TEMPERATURE (AND CLEANING ACTION HAS STOPPED), **PERC** HAS ALREADY PRODUCED 6% MORE CONDENSATE—**AND IS STILL CONDENSING,** GIVING EXCELLENT CLEANING AT THESE HIGH TEMPERATURES ...

... UNTIL THE METAL HAS REACHED THE HIGHER MAXIMUM **PERC** VAPOR TEMPERATURE. **PERC** DEGREASING GIVES AT LEAST **60% MORE** CLEANING ACTION THAN TRI!

Metal finishers are converting to degreasing systems designed for Perchlorethylene because of its greater efficiency in cleaning and solvent recovery. In your present or contemplated installation you'll want Stauffer's specially stabilized degreasing grade of Perchlorethylene. **STAUFFER CHEMICAL COMPANY, 380 Madison Avenue, New York 17, N. Y.; sales offices in principal cities.**

Stauffer CHEMICALS SINCE 1885

STAUFFER PERCHLOROETHYLENE



HILL Sheet Grinder and Polisher with reciprocating hydraulic table processing individual sheets.

HILL

GRINDING and POLISHING MACHINES

How much is it costing you to produce ACCEPTABLE finishes on FLAT surfaces

HILL Pinch Roll Grinder and Polisher for "Wet" or "Dry" operations. (Shown in series for straight line production)

HILL 2-Roll Vertical Abrasive Belt Grinding and Polishing machines are the logical result of 25 years of research and experience in producing self contained units for successfully processing ferrous and non-ferrous sheets. We have consistently proven that wide abrasive belt grinding and polishing equipment must incorporate these fundamental features — rugged construction, simplicity of design, accessibility, versatility and centralized controls.

HILL abrasive belt polishing machines are recommended for continuous operation and insure lower production costs with superior finishes as required today by the manufacturers of decorative plastics, food processing equipment, automobile bumpers, lithographers and photo engravers plates, home appliances, etc., etc.

Both types of machines are normally built up to 60″ wide, and larger capacity equipment can also be furnished.

Your inquiries are solicited for detailed information and recommendations.

TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

because it offers the best results...

most platers continue to prefer...

McGEAN BRIGHT NICKEL

for further information ... contact ...

THE McGEAN CHEMICAL COMPANY

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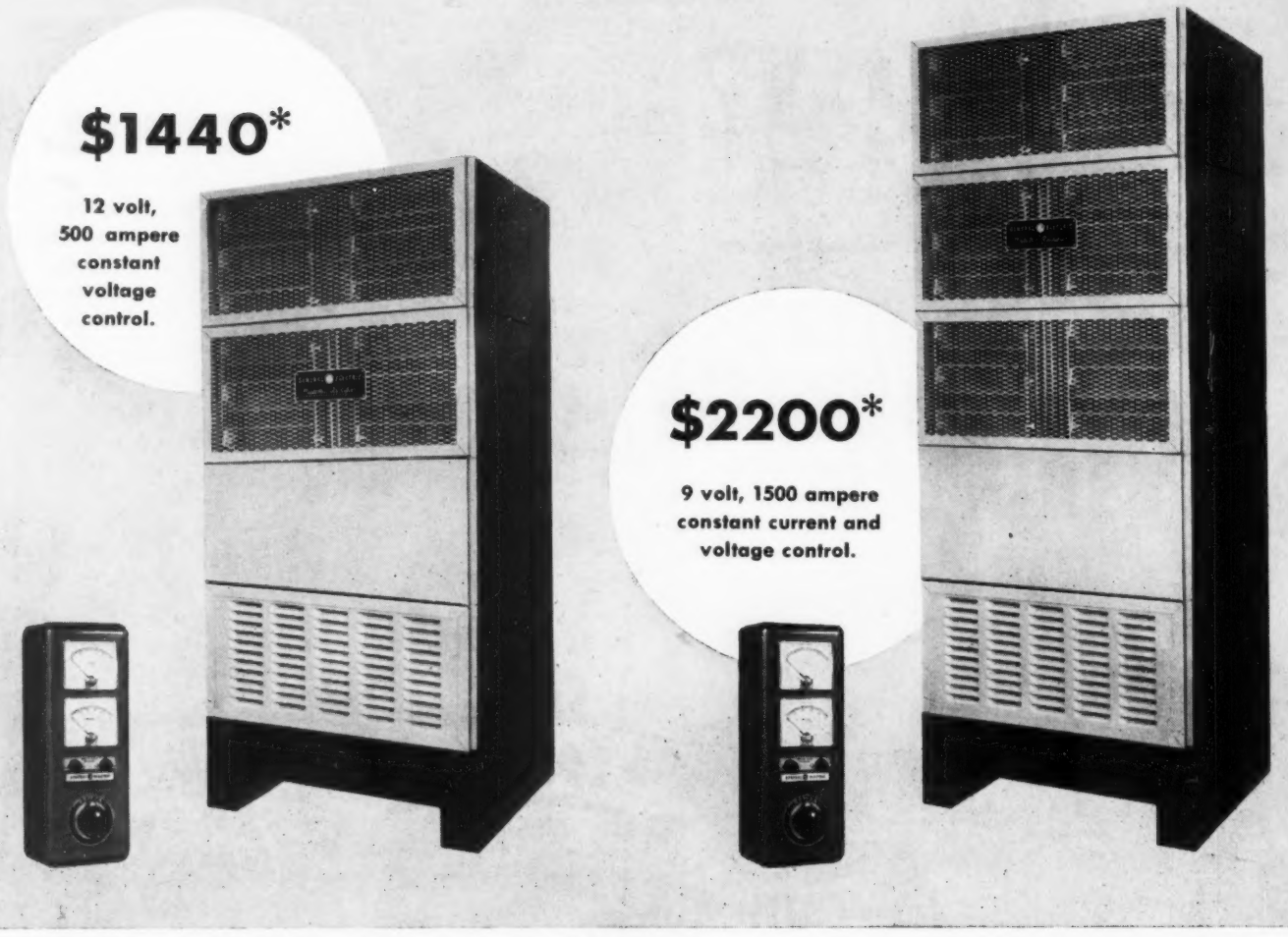
McGEAN

anodes and electroplating chemicals



NOW Low Prices on G-E Automatic Make "Automatic Savings" Available to

TRIM ALLOYS, INC., OF BOSTON SHOWS HOW G-E AUTOMATIC POWER SUPPLIES SAVE LABOR, SPOILAGE, AND MAINTENANCE.

Lower prices on General Electric automatic plating rectifiers now let you take a big step toward complete automation . . . at low cost.

Besides bringing within your reach the savings of automation, G-E automatic plating power supplies are designed to assure you of uniform plating.

The Trim Alloys, Inc., installation was engineered by The Chemical Corp., Springfield, Mass.

HERE IS THE REPORT OF TRIM ALLOYS, INC., which uses G-E automatic plating power supplies for anodizing aluminum extrusions: "Ours is a high quality process, yet we don't want to waste time, manpower, or materials. In order to maintain our high standards with manual control, we would need a man on the controls all the time. With G-E automatic control, however, we free our operators for other work . . . and get much better control, too. We simply push the start button and the unit seeks its own best setting for that particular load, shutting itself off at precisely the same interval each cycle."

Progress Is Our Most Important Product

GENERAL ELECTRIC

COMPARE THE PRICES OF THESE LARGER UNITS

24-volt, 4000-ampere unit with automatic anodizing control—$8860*

9-volt, 10,000-ampere unit with automatic voltage control—$10,080*

24-volt, 3000-ampere unit with automatic anodizing control and sealed, oil-cooled stacks———$8380*

** Manufacturer's suggested user price.*

Plating Rectifiers Every Plating Shop

AN INCREASING NUMBER OF PLATING SHOPS are discovering that G-E plating power supplies with automatic control cut plating costs in three big areas:

1) LABOR—No one needs to stand by the controls to adjust for changes in the tank load. Plating operators can be freed for other operations.

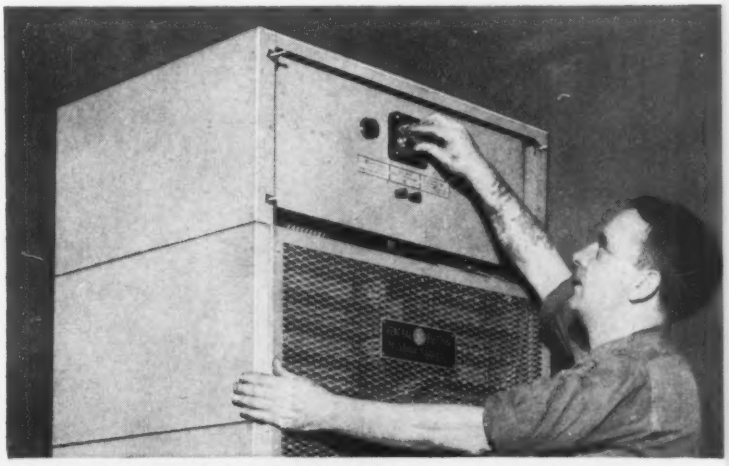
2) SPOILAGE—Spoilage is reduced, since deposition is kept uniform by the constant current or voltage. This reduction in spoilage means fewer rejects . . . less re-working expense.

3) MAINTENANCE—Maintenance is kept low, because both the G-E automatic control and rectifier are mechanically static. Except for the cooling fan, there are no moving parts.

BEFORE YOU BUY ANY PLATING RECTIFIER, check G.E. for the three types of automatic regulation available: (1) voltage, (2) current, and (3) anodizing.

For full details, contact your G-E plating agent, or send in the coupon.

UNIFORMLY ANODIZED EXTRUSIONS are removed from the tank at Trim Alloys, Inc. Automatic control, assures uniform, high-quality anodizing every time, resulting in fewer rejects.



THE DESIRED ANODIZING SEQUENCE is set up by the operator at the rectifier control panel. Once set, the anodizing sequence is completely automatic, requiring no further adjustment.

THE REMOTE-CONTROL STATION is conveniently located within easy reach of the operator right at the anodizing tank.

Section A463-13, General Electric Co., Schenectady 5, N. Y.

I would like to receive additional information on how I can save money when I plate with G-E automatic plating power supplies. Please send me bulletin GEC-970A.

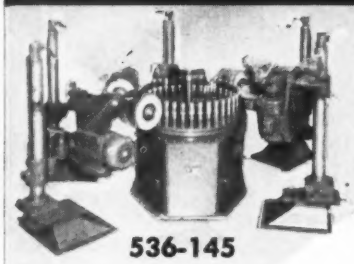
NAME .....

COMPANY .....

ADDRESS .....

CITY & STATE .....

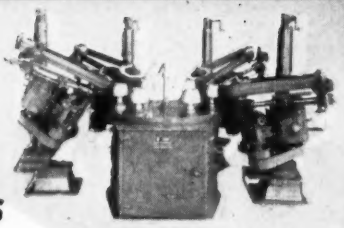
ACME *Rotary Automatics*



536-145

. . . cut costs on production finishing

ROTARY TABLES ARE AVAILABLE IN SIZES UP TO 24 FT. DIAMETER



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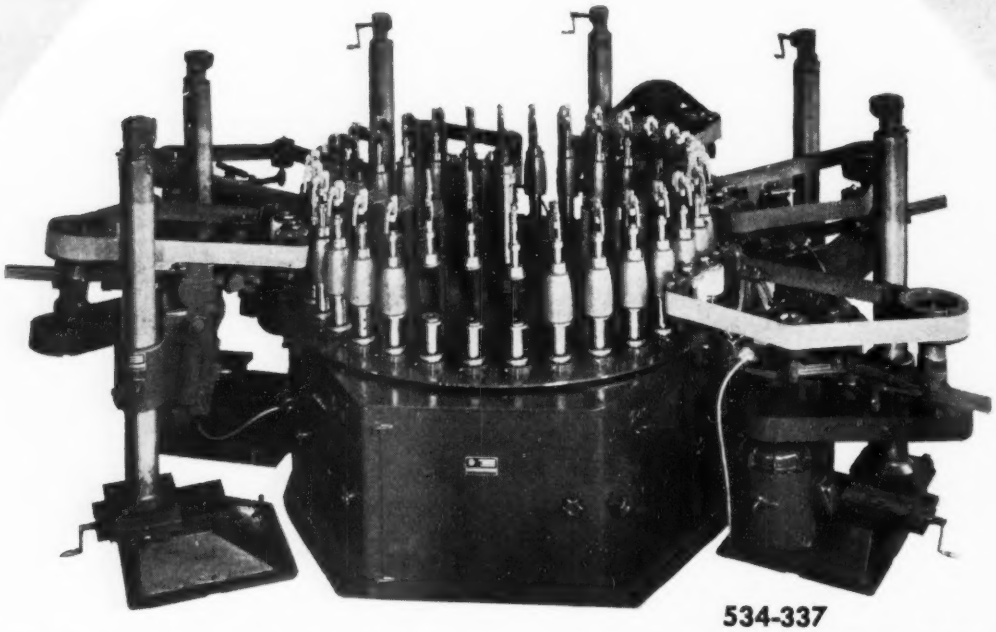
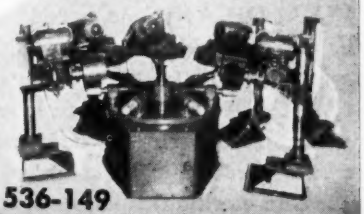


534-337

ACME 8 FT. *Combination Type* ROTARY AUTOMATIC

● This machine can be readily changed from a 32 spindle continuous rotary automatic to an 8 station indexing rotary automatic by simple hand crank adjustment. Various types of ACME adjustable floating head polishing and buffing lathes are used including belt arm attachments on buffing heads, utilizing the same heads for buffing or belt operations. Spindle arrangements are available in multiples of 8.

Rotary Catalog on Request.



536-149

RECOMMENDATIONS and QUOTATIONS . . . will be offered on receipt of blue prints or preferably finished and unfinished parts you contemplate finishing, together with details of your present finishing operations and production requirements.

SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

ACME *Manufacturing Co.*

1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

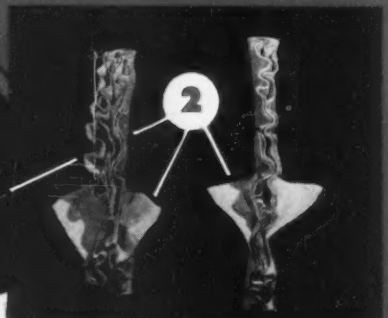
Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

No other Buff...

has all these advantages

CODMAN NON-FRAY BUFFS

1. THICKNESS OF RING VARIES DENSITY
2. TRAILING ENDS — (Safety)
3. NON-COMPRESSIBLE CONSTRUCTION
4. NON-METALLIC CENTER — (No Shaft Scaring)



OPEN FACE CLOSED FACE

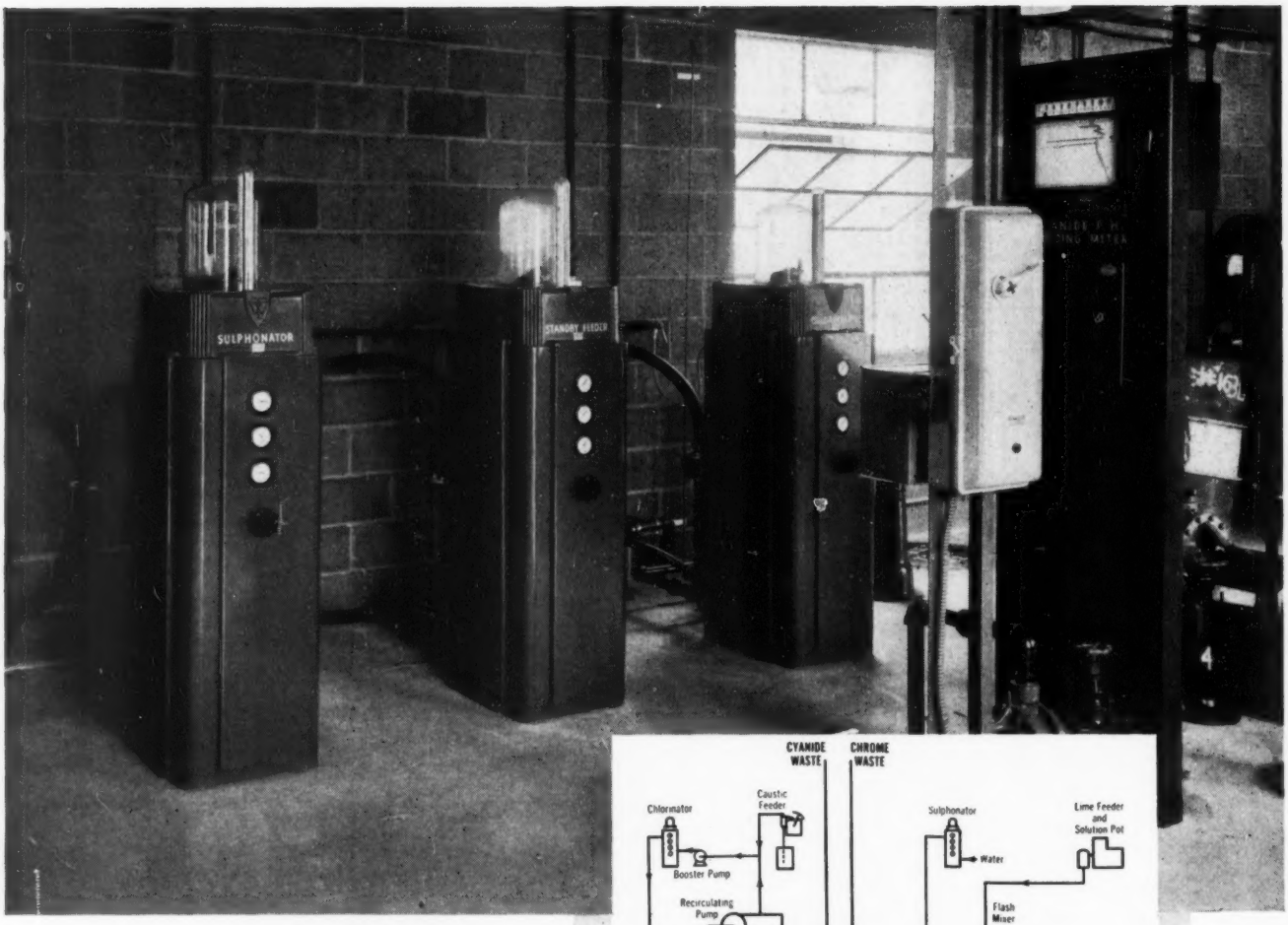
Available-Closed or Open Face Ventilated, Of Course, When Necessary

F. L. & J. C. CODMAN COMPANY

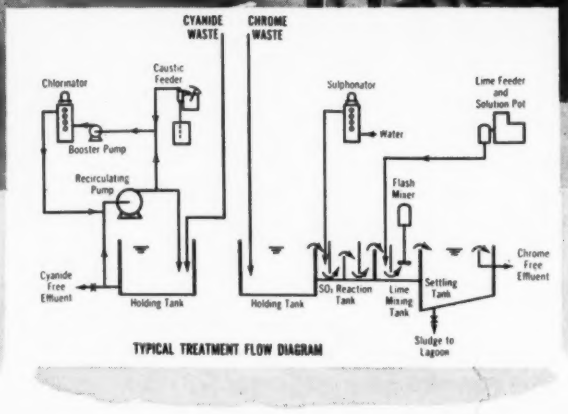
ROCKLAND, MASSACHUSETTS

the greatest name in buffs for over 55 years

BRANCH OFFICES — PHILADELPHIA, DETROIT, LOS ANGELES, INDIANAPOLIS, GRAND RAPIDS



DAYSTROM INSTRUMENT DIVISION USES



TYPICAL TREATMENT FLOW DIAGRAM

W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide to harmless carbon dioxide and nitrogen gas components.

The chromium bearing waste is treated with sulphur dioxide and lime, using a W&T Sulphonator and a W&T Dry Chemical Feeder. The treatment removes the toxic chromium and other heavy metals from solution, to be disposed of as sludge.

If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CM.

WALLACE & TIERNAN INCORPORATED

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1-52

NEW... from Wyandotte

Expray-AP

An all-purpose, rust-inhibiting metal cleaner for spray washers

Here's a new alkaline spray cleaner that fills a definite need in metal cleaning. Not just an improved version of cleaners already on the market, Wyandotte's EXPRAY-AP is unique . . . research-developed, proved in use. Here are some typical spray-cleaning applications:

Steel parts — EXPRAY-AP is excellent for removing fabricating soils and preventing rust — even cold in a one-stage washer.

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Cast-iron parts — EXPRAY-AP removes chips and dust, prevents rust on machined surfaces.

Glass — EXPRAY-AP eliminates streaking, removes pitch, rouge, and oils from lenses and other glass products.

If you're looking for ways to improve your metal-cleaning or finishing operations, call in your Wyandotte representative. Let him show you what EXPRAY-AP can do in *your* plant. Or clip and mail coupon today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, Calif. Offices in principal cities.*

EXPRAY-AP gives you all these benefits — *and more!*

Powerful cleaning action — contains free-rinsing synthetic detergents!

Easy to use — noncaustic, nondusty, free-flowing!

Low-foaming — even at high concentrations and in high-pressure washers!

Prevents scale — even in hardest water!

Prevents rust — contains its own rust inhibitor!

Economical — lower use-cost and reduced equipment maintenance!

Wyandotte
CHEMICALS
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WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan

Please send me further information and technical data on EXPRAY-AP.

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Company_____

Address_____

City_____ Zone____ State_____

Before the opening of new facilities at Painesville, Ohio (top photo) . . .

New Chromic Acid Plant Brings Faster Service, Lower Freight Rates to Mid-West Platers

. . . DIAMOND produced all its chromic acid at Kearny, N. J. (bottom photo). Now, DIAMOND has two completely integrated plants.

With the addition of a basic chromic acid installation at Painesville—first in the mid-west—DIAMOND now offers platers outstanding service, faster deliveries, lower freight costs.

DIAMOND facilities—two chromic acid plants and nine warehouse points and sales offices across the country—assure you uninterrupted supply. DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS ®

DIAMOND CHROMIC ACID

EFFICIENT . . FLEXIBLE . . COMPACT

Murray-Way's New #55 Head

GIVES YOU THESE POLISHING AND BUFFING ADVANTAGES:

GUARANTEED SPINDLES—All Murray-Way 55 Spindles are GUARANTEED FOR 3 YEARS. Factory-tested spindles incorporate heavy-duty, anti-friction bearings that require no grease or oil and are sealed against dirt for trouble free performance.

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SMALL FLOOR SPACE—The 55 Series Heads will install in line on 5'8" centers. They conserve floor space, economize on conveyors, and reduce fixture requirements.

UNIVERSAL POSITIONING—With the Murray-Way adjustable fulcrum head, you get universal positioning by means of simple, accessible adjustment controls at the front of the head.

RUGGED—These heads are truly heavy-duty workhorses with 30 H.P. capacity.

FULL WORK CONTACT—On even the most irregular work shapes, Murray-Way's 55 Heads remain in constant contact—NO EXTRA PASSES—LOWER OPERATING COST—MORE PRODUCTION.

The technical know-how of Murray-Way's experienced engineers is the reason that production men who want a BETTER WAY . . . SPECIFY MURRAY-WAY.

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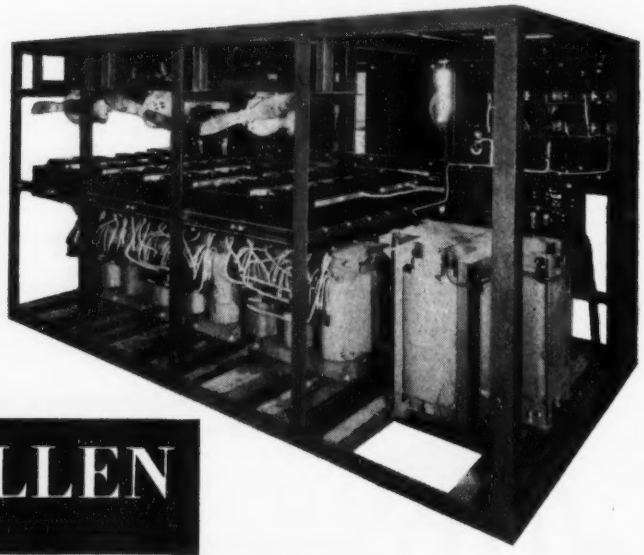

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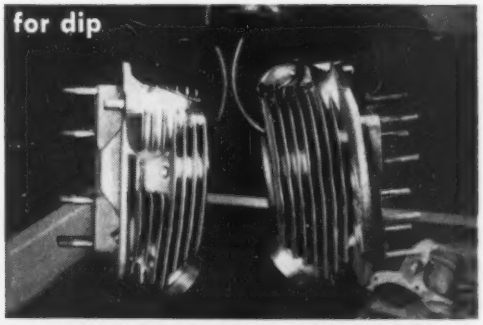

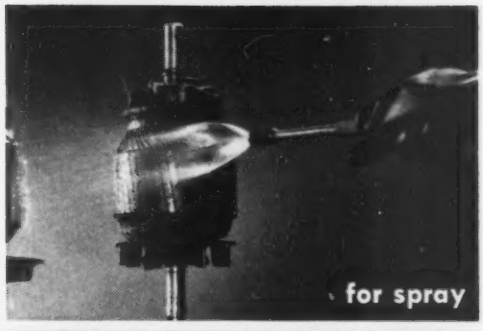

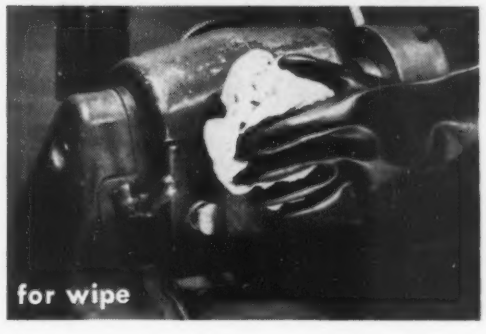

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†203 *26 April 1955*

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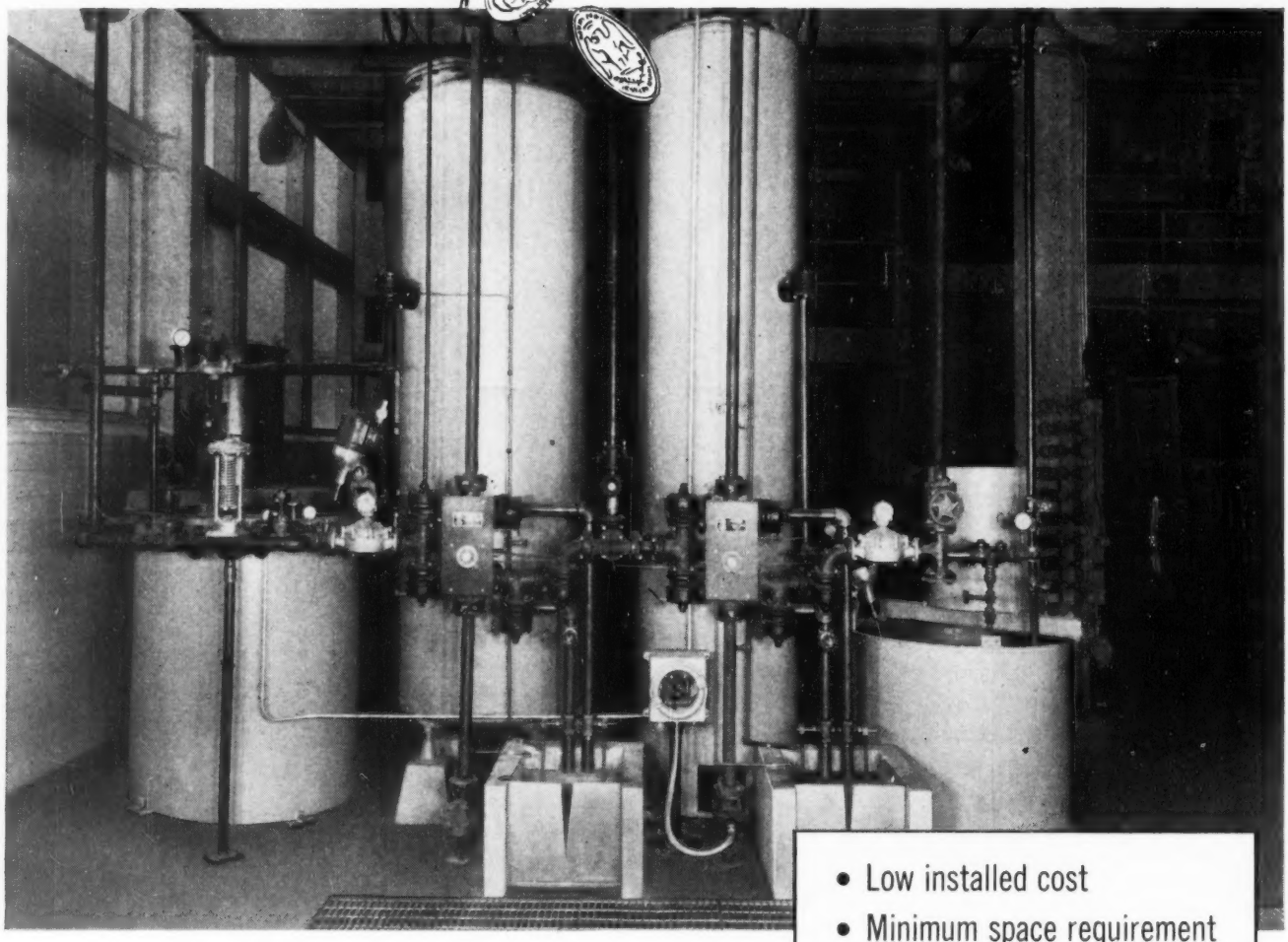

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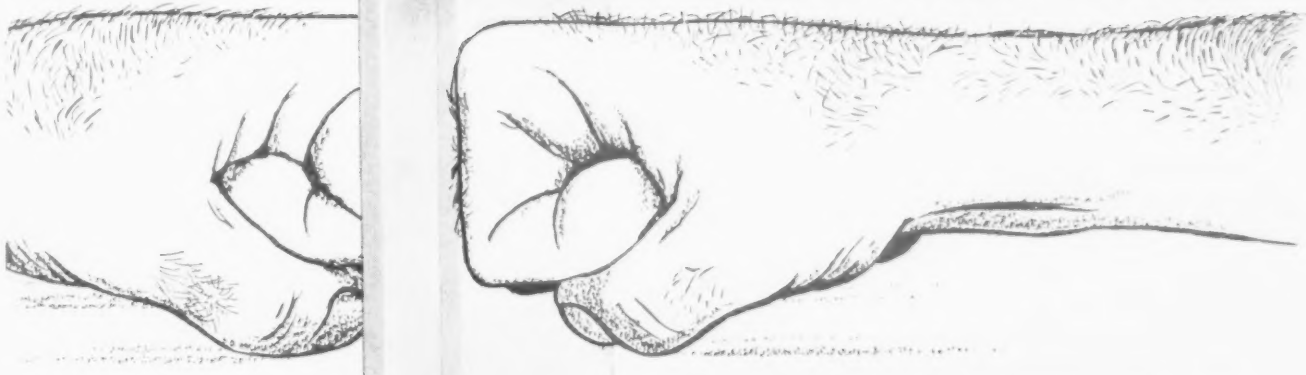
PUTS "MUSCLES" INTO YOUR ALUMINUM WELDS



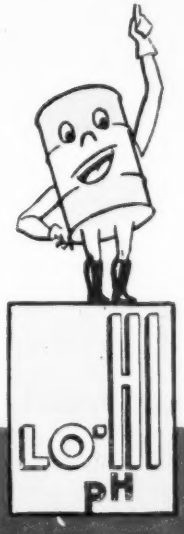
ALKALUME—another great Northwest Chemical Process—is your answer to chemically clean aluminum necessary for successful welding. This safe, simple, economical process removes soils and oxides chemically—no wire brushes or other mechanical devices to waste metal and slow production. Surface resistance is reduced to a value of 0 to 10 microhms, and a resistance of less than 20 microhms will persist for days.

The Alkalume Process assures you a reliable—day after day—production of a uniformly weldable surface—regardless of alloy. Processed stock welds fast and easily producing welds that meet specified values for penetration and shear strength. In addition, with Alkalume Processed Stock, welds are made at lower pressure. The Alkalume Process reduces the number of tip dressings, thus giving you greater tip life.

ALKALUME'S outstanding success is another fine example of Northwest's ability to get the toughest jobs done by careful blending of good chemicals and experienced service control. The complete story of Alkalume or any of Northwest's fine line of cleaning chemicals is yours for the asking. A Northwest CLEANING SPECIALIST will gladly help you with your problems.

Got a problem? Let our cleaning experts help you!

Write for complete literature on the ALKALUME Process



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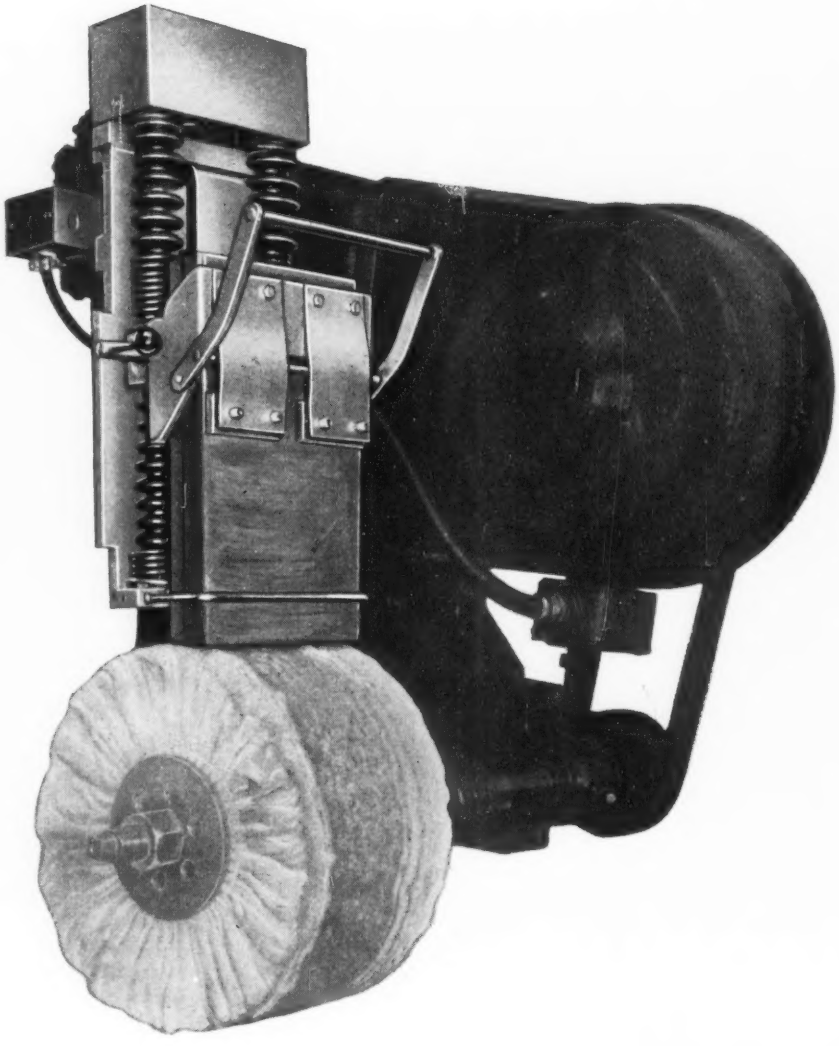
It is designed to hold any length bar compound and rouge 2″ thick, and will feed 10″ of compound to a buffing wheel in one setting.

Power is provided by a 1/20 H.P. motorized reducer drive — 115 volts, single phase; 220 volt unit optional.



ADAPTABLE TO AUTOMATIC, SEMI-AUTOMATIC AND HAND JACK EQUIPMENT

For further details on the Model #60 Applicator, phone, wire, or write E. C. Ness.

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AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

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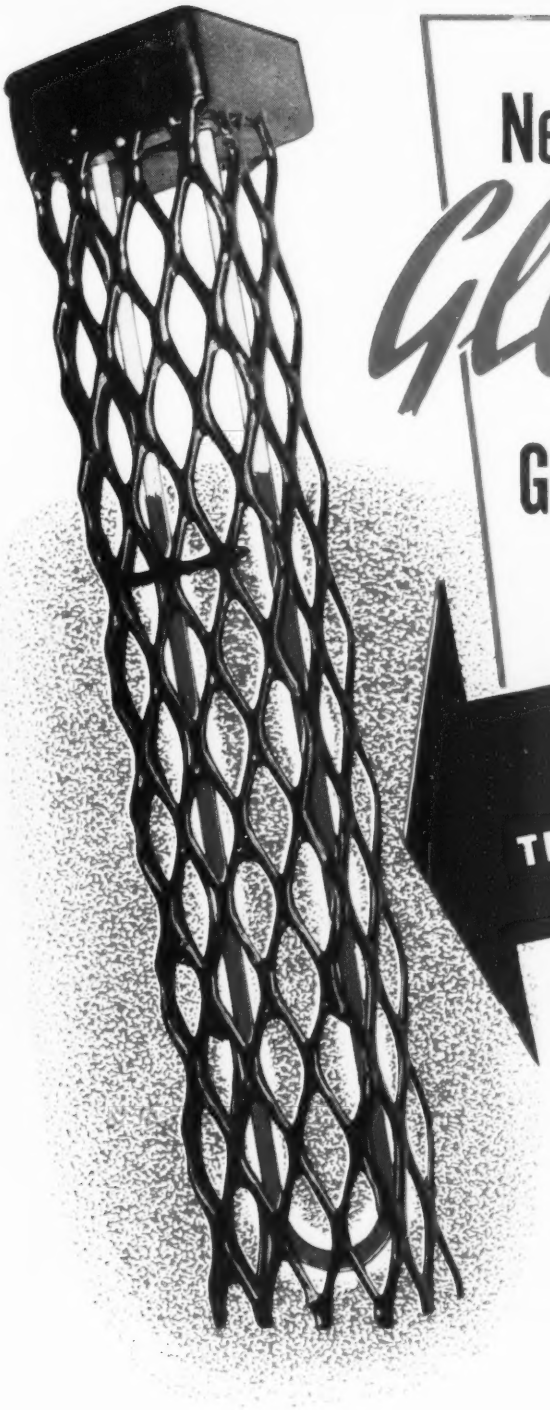

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new BAIRD MODEL H - OBLIQUE TILTING TUMBLING MACHINES

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Master Anodizers and Plating, Inc., Bedford, Ohio—get uniform aluminum etching with Cowles AK Aluminum Etchant even on very long strips, where shading will show up if the etching isn't absolutely uniform.

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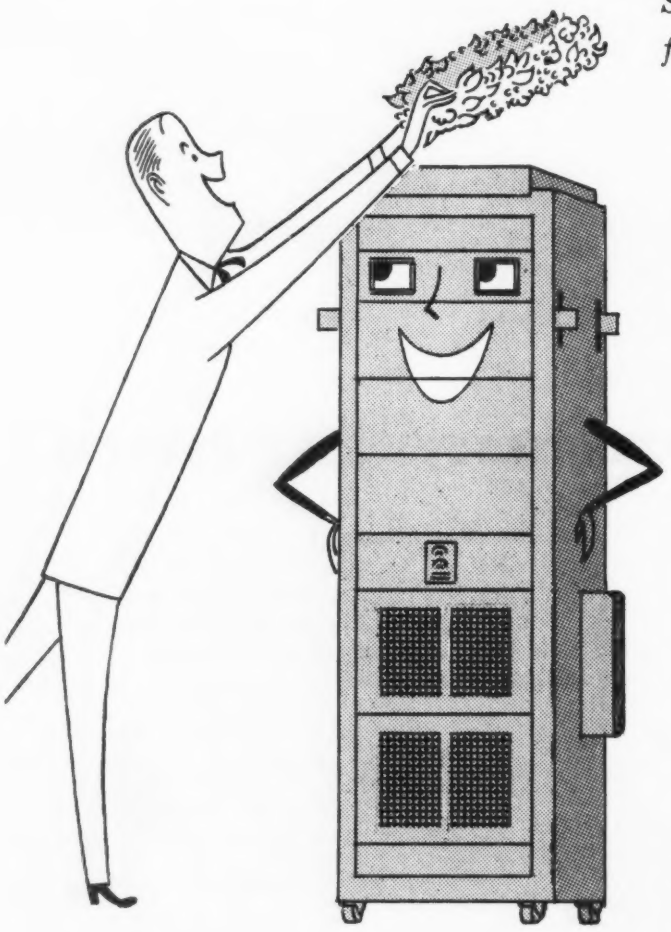

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Some of the standard and special features in Munning-Green Rectifiers:

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- Dual, triple and quadruple output
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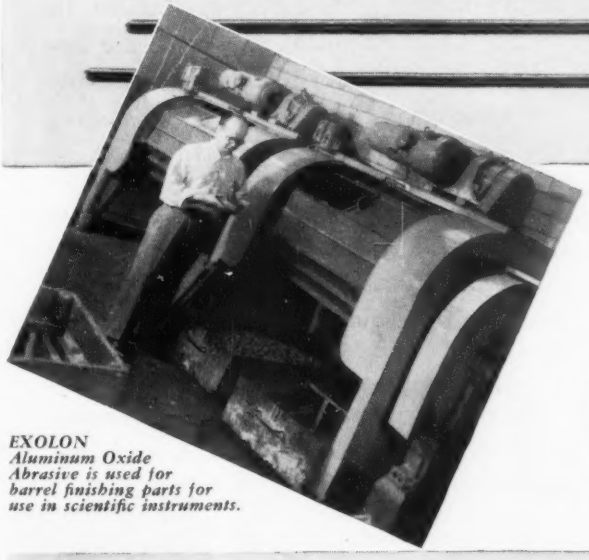
NOW... Finish Precision Parts with EXOLON Tumbling Abrasives



EXOLON Aluminum Oxide Abrasive is used for barrel finishing parts for use in scientific instruments.

EXOLON Tumbling Abrasive is carefully graded in sizes from 2½ inches down to fine powders.

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Precision parts shown above were barrel finished with EXOLON to a predetermined stock removal and surface finish. Whether your parts are castings, stampings or machined parts, there is an EXOLON abrasive to meet your finishing needs. An EXOLON representative is available to help you with your barrel finishing problems.

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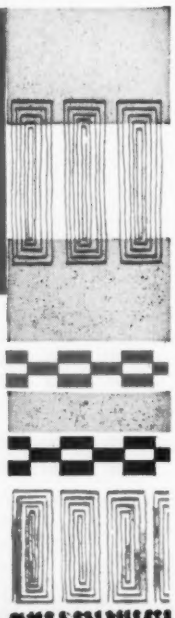

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The high-quality sisal used in **every** JOE-D Buff is grown and specially woven for JOE-D in Yucatan, Mexico. Top quality raw material is one reason why JOE-D Sisal Buffs are the finest on the market — **fast-cutting, long-lasting.** And JOE-D's **original** bias construction guarantees **frayproof** performance — never a loose thread end to scratch or mar. Insist on **original** quality . . . specify JOE-D —you can't buy a better buff!

The JOE-D line covers a complete selection of Bias, Bias Sisal, Bias Spoke (Finger) and Conventional Buffs—as well as quality Polishing Wheels.

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A

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Resists Corrosion

The hard, brilliant white finish of Rhodium plate strongly resists corrosion, making it ideal for electrical and electronic applications. This exceptional property assures protection against atmospheric conditions, providing an excellent finish for ultra-high frequency applications. Its hardness and chemical resistance are unmatched for use with reflectors, particularly with the open arc.

Rhodium plate retains its highly reflective surface indefinitely and does not diminish on exposure to corrosive atmosphere. For decorative, industrial and commercial applications, Rhodium plate qualifies as the top finishing material.

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PROCESS OF ELECTRODEPOSITION

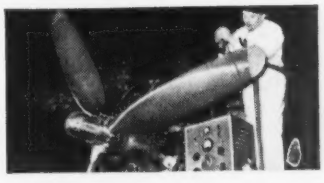
The DALIC PROCESS of Electrodeposition provides a wide range of coatings on to most basis materials, including aluminum. It is particularly suitable for plating selected areas without stopping-off, for on-site work and for plating assemblies or components which may not be immersed in plating solutions.

For such non-decorative purposes as building-up worn or over-machined parts, the extremely high speed of deposition and the accuracy with which deposit thickness can be controlled are most attractive features. Deposits are characterized by low stress, extremely fine grain, perfect adhesion and complete absence of porosity.

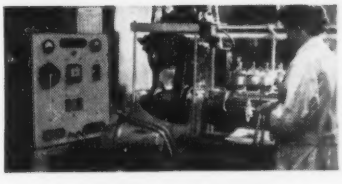
The DALIC PROCESS has received favourable acceptance by industry throughout Europe and installations have been made in the electronics, electrical, aircraft, automotive, armaments, radio and television industries and in various research establishments.

Deposit	Maximum Current Density Amp./ft. 2	Time to deposit 0.0001 in. * (secs.)	Brinell Hardness of deposits
Bismuth	1,500	7.6	50
Brass	—	—	—
Cadmium	6,000	2.5	40
Chromium	4,000	63.0	600
Cobalt	1,500	7.6	250
Copper	6,000	2.5	150
Gallium	1,000	17.8	—
Germanium	4,000	—	—
Gold	2,000	6.2	100
Indium	4,000	2.5	1
Iron	3,000	10.2	175
Lead	5,000	3.8	20
Nickel	5,000	5.1	500
Nickel (Black)	5,000	—	—
Palladium	1,500	10.2	150
Platinum	3,000	17.5	200
Rhodium	3,000	70.0	500
Silver	1,250	5.1	60
Thallium	2,000	12.6	—
Tin	5,000	2.5	1
Zinc	3,000	3.8	70

* On an area equal to the pad electrode used.



Leading edge of propellers being plated following wear.



Copper plating bore and keyway on pinion prior to carburizing.

Building up worn shafting.

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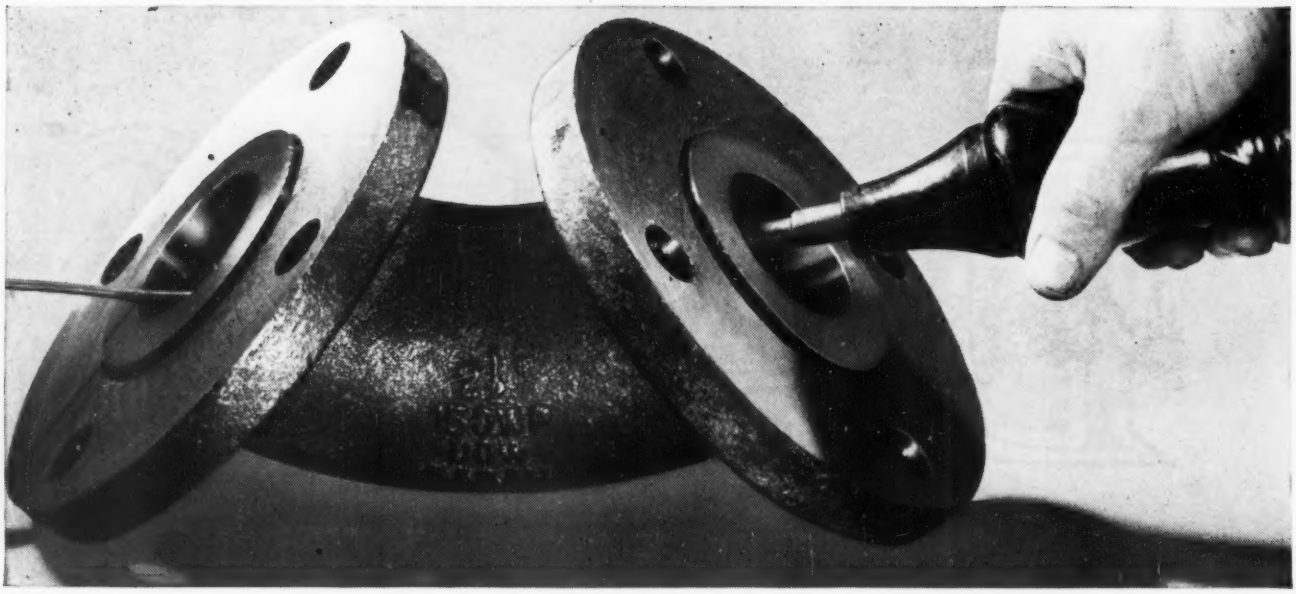

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KEEPS SHUTDOWNS TO A MINIMUM

It's made of corrosion-resistant saran pipe swaged into strong, rigid, nonbursting steel. And every piece is spark tested before you buy!

Unscheduled shutdowns are a thing of the past when you use saran lined pipe, fittings and valves to convey corrosive liquids. This modern, trouble-free piping is corrosion resistant . . . forms tight, snug, leakproof joints . . . won't burst under *working* pressures up to 150 psi. And every single piece of saran lined pipe is carefully spark tested by hand to be sure that there are no pinpoint holidays or cracks in its lining. Cast steel lined fittings are available for higher pressures.

Installation costs are surprisingly low with saran lined pipes, fittings and valves, too. They can be cut and threaded in the field with standard pipe-fitter's tools. Their rigidity means few supporting members are needed.

If you want to convey acids, alkalies, or other corrosive liquids at low over-all cost, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP528C-2.

RELATED SARAN PRODUCTS

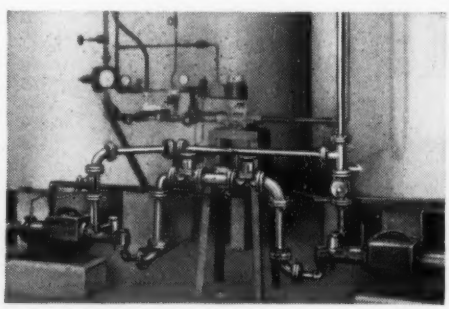
Tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

SOME OF THE MANY INSTALLATIONS USING

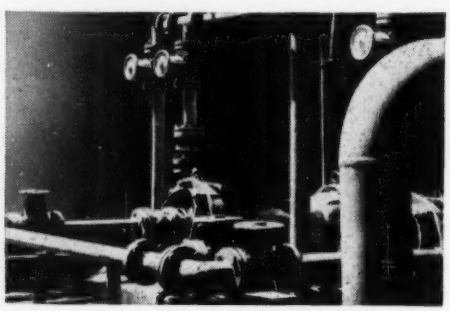
SARAN LINED

STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan



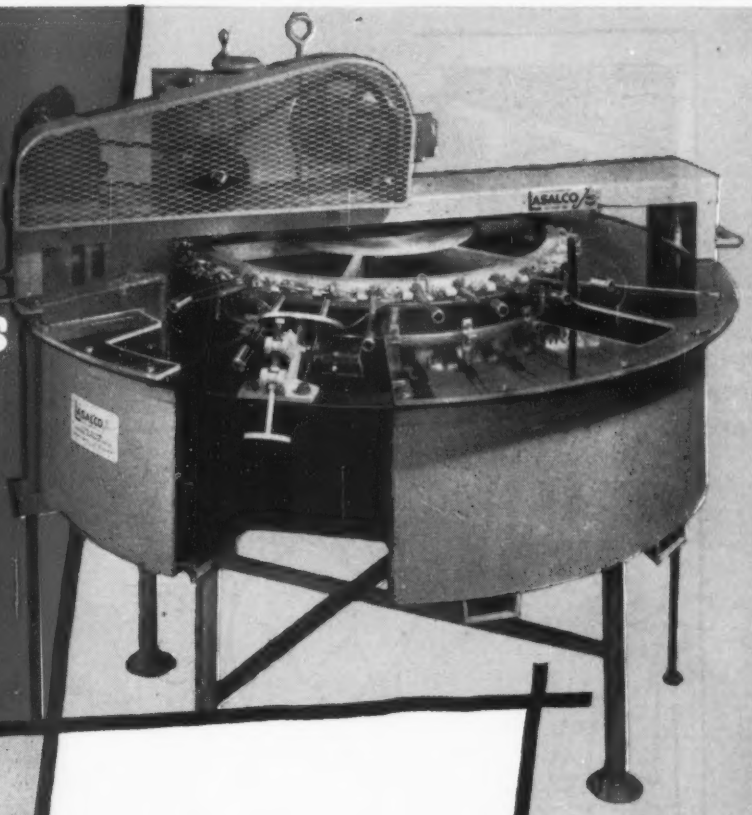
A large Southeastern paper mill uses saran lined pipe to handle corrosive alum solution. It has proved to be an exceptionally satisfactory answer to eliminating unscheduled shutdowns.



This installation of a large Midwest company has conveyed highly corrosive hydrochloric acid for over seven years. The joints have remained as tight and leakproof as new.

you can depend on DOW PLASTICS DOW

Chrome Plate over 3200 Pieces Per Hour with One Operator!



LASALCO's *New* CIRCULAR CHROME PLATER

Cost-cutter . . . time-saver . . . production-booster! Consider the unusual extra profit possibilities with this new high current density, continuously-moving cathode chrome plater:

- Exceptionally high output—3290 pieces, up to 3" long, per hour at 23 seconds. Minimum output, 530 pieces per hour at 2.39 minutes. (Alternate slower drives for heavier plating.)
- One-man loading . . . fully automatic unloading.
- No racks . . . no rack upkeep.
- Easily removable sectionalized cover of Plexiglas, plus easy-to-raise driving mechanism and cathode wheel, gives quick access to coils and anodes. Parts falling into tank are instantly recoverable.
- Simple installation requires only electrical connections and exhaust duct. Plater delivered complete, ready to install.

SPECIFICATIONS

Cathode Wheel Diameters 30". 31 Bronze Work Carriers 3.24" O.C.
Effective Plating Travel 68.4".
Inner Anode Diameter 24"; Outer Anode 40".
Center Of Anode To Cathode 4".
Tank Diameter 54"; Depth 14".
3/32" Koroseal Lining.
Solution Capacity 115 Gals. 2" From Top.
Anodes: Flat 16 lb. 6% Antimonial Lead—Outer ¼"x9"x7'5"; Inner ¼"x9"x4'8". Anode and Cathode Taps ¼"x2". Copper Bars.
Bused For 500 Amps.
Heating (Standard): ¼" I.D. 6% Antimonial Lead Steam Coil. (Available For Electric Heating.)
Drive: ¼ HP 110/220 1- Phase 60 Cycle AC Motor. Variable Speed Reduction.

Write Now . . . Get The Facts About This Money-Maker

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Just the HARD FACTS, Mam

. . . about

NEW AHCO COMPOUNDS

for AUTOMATIC BUFFING

High-speed automatic buffing needs very hard and stable compounds to operate efficiently — hard to withstand tough usage . . . stable to withstand extreme heat. Now Apothecaries Hall Company has formulated a new series of high speed buffing bars that always adhere to the wheel, never lose their abrasive quality.

This new Ahco series includes tripoli bars, white bars, and other compounds for buffing surfaces from plastics to non-ferrous metals, steel, and stainless. There is a wide variety of uniform sizes for all types of machines.

Like all Ahco compounds, these new high-speed bars are manufactured under strict laboratory control to assure outstanding performance. Investigate these latest results of Ahco research NOW.

For full details about Ahco Compounds for automatic buffing, write today to Apothecaries Hall Company, 22 Benedict Street, Waterbury, Connecticut.

Apothecaries Hall Co.

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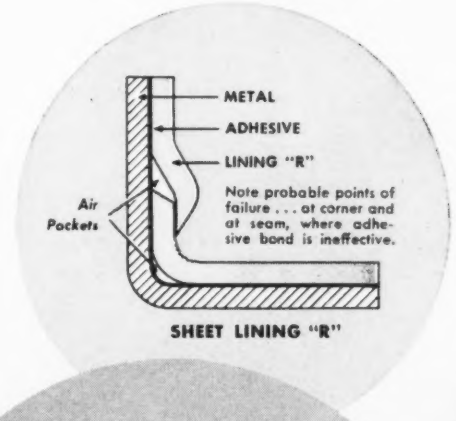
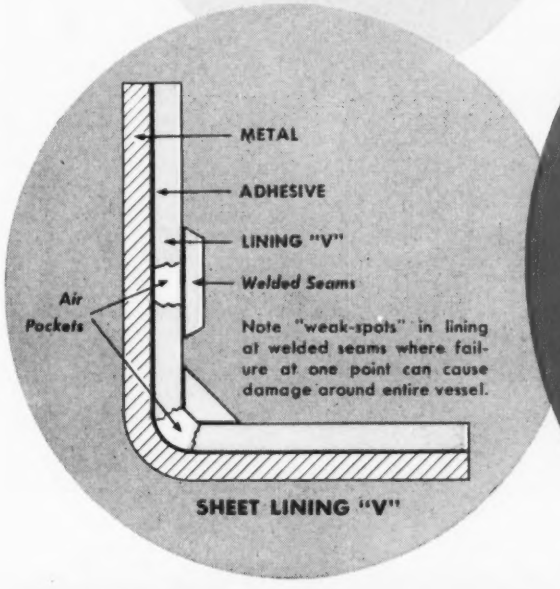
A and P FINISHING

TP-111

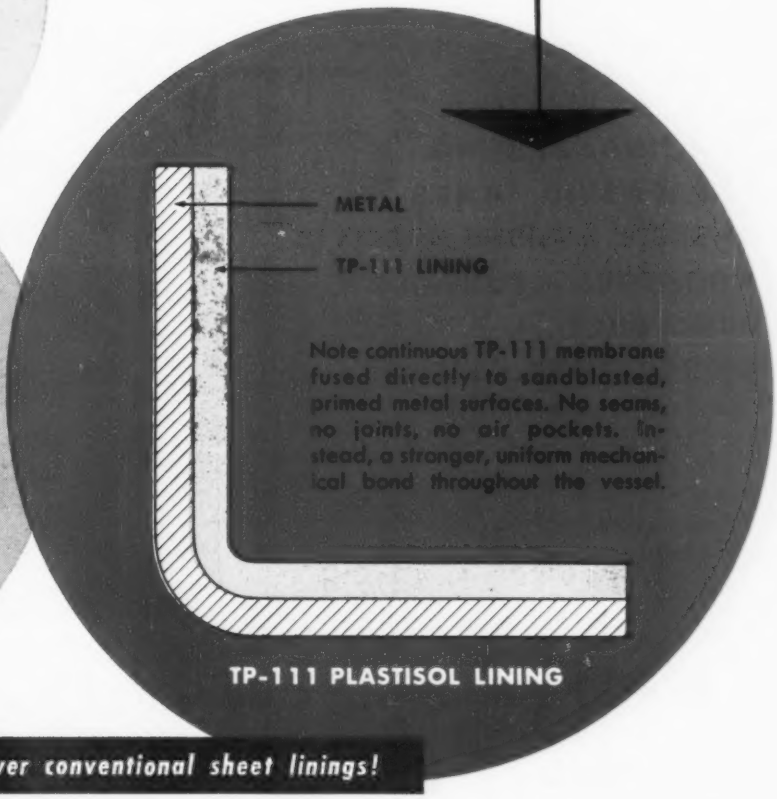
the improved sprayable plastisol that forms a continuous, seamless protective lining fused directly to the primed metal surfaces of your plating and processing equipment


METAL
ADHESIVE
LINING "R"
Air Pockets
Note probable points of failure . . . at corner and at seam, where adhesive bond is ineffective.

SHEET LINING "R"


METAL
ADHESIVE
LINING "V"
Welded Seams
Air Pockets
Note "weak-spots" in lining at welded seams where failure at one point can cause damage around entire vessel.

SHEET LINING "V"


METAL
TP-111 LINING
Note continuous TP-111 membrane fused directly to sandblasted, primed metal surfaces. No seams, no joints, no air pockets. Instead, a stronger, uniform mechanical bond throughout the vessel.

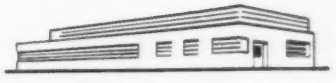
TP-111 PLASTISOL LINING

Compare the advantages of TP-111 over conventional sheet linings!

- **CONTINUOUS MEMBRANE**—As applied by A & P Finishing specialists, TP-111 forms a continuous membrane lining completely free of the joints, seams, and air pockets normally found in conventional sheet linings. Such breaks in a lining are generally considered weak spots where failure would permit liquid to flow to various parts of the vessel, causing extensive damage and loss of current density.

- **STRONGER BOND**—A & P Finishing TP-111 is fused directly to primed, sandblasted metal surfaces . . . thus effecting a stronger mechanical bond than that produced by adhesives used with conventional linings. This also permits use of TP-111 on higher temperature applications where adhesives are apt to soften causing a separation of the sheet lining from the base metal. Further, in the event of accidental damage to the TP-111 lining, chemical attack and undercutting is localized.

- **CONTROLLED HARDNESS**—The film hardness of TP-111 can be controlled to meet individual job requirements by A & P Finishing specialists. In addition, greater chemical and abrasion resistance can be effected through formulation and curing techniques which produce an unusually dense and durable membrane.



* ***POSITIVE PROTECTION*** — Protective linings are only as effective as the method by which they are applied. That's why it pays to insist upon proven A & P Finishing TP-111 linings as installed in our plant by workmen recognized as pioneers in this field. All work guaranteed and surprisingly low in cost. Available, too, through equipment manufacturers and plating jobbers. Write for details today!

A and P FINISHING AND MANUFACTURING CO.

17760 CLARANN AVENUE
MELVINDALE (Detroit) MICHIGAN
Telephone **WArwick 8-7515**

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AGITATORS • PUMPS
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Metal Finishing Corrosion has been Controlled!

All Haveg equipment has extra long life, extreme resistance to corrosive chemicals, and can be used continuously in a high range of process temperatures with complete safety and a proven history of performance.

Because Haveg corrosion-resistant tanks prevent specking or flaking of the finished product, the number of rejects is reduced and the plating job is uniform. Solutions do not build up on Haveg, thereby clean-up time is reduced.

Molded Haveg tanks are made in a single piece construction. Any size, style, baffle arrangement can be supplied to fit your process. Equipment is virtually tailor-made for longer service life, improved production.

Remember, Haveg is not a coating or tank lining. It is a moldable rigid plastic material, made from acid-digested asbestos and synthetic resins specially selected for difficult service with practically all acids and salts, chlorine, many solvents. Throughout its entire mass, Haveg is resistant to practically all solutions used for finishing metals. Its long life is not a claim, but a fact proven in hundreds of installations.

Haveg can help you make your finishing operations more profitable and less subject to the waste of corrosion. Call the sales engineer listed and write for 32-page Bulletin C-12 which shows tank sizes, shapes, chemical ratings . . . the complete Haveg story.

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CLEVELAND 20, Washington 1-8700 • LOS ANGELES 14, Mutual 1105
WESTFIELD, N. J., Westfield 2-7383

HAVEG CORPORATION

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900 GREENBANK RD., WILMINGTON 5, DEL. • WYman 8-2276

Sturdy, Space-saving VS-3 HONITE Barrel Finishing Machine

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☐ Pivoted safety gate —no slides or rollers to stick or jam.

☐ All lubrication points are open and accessible.

☐ Handy height controls, switches and speed changer located at right side of barrel. No stooping — no stretching.

☐ Cylinder can be removed from the front without disassembly.

☐ Steel frame absorbs drive stresses without transmitting shock to supports.

☐ Oversize pillow blocks and self-aligning bearings carry full loads of steel burnishing media.

☐ Chain guard covers drive even when safety gate is raised.

☐ Shafts are jig-bored for cylinder mounting to insure alignment on axles within .005".

☐ Plenty of space under the barrel to speed unloading. Two hoist pans can be used if necessary.

WANT MORE INFORMATION?

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Minnesota Mining and Mfg. Co.
Dept. DS-115, St. Paul 6, Minn.

I'd like to talk to a HONITE Methods Engineer about the new HONITE Barrel Finishing Machine.

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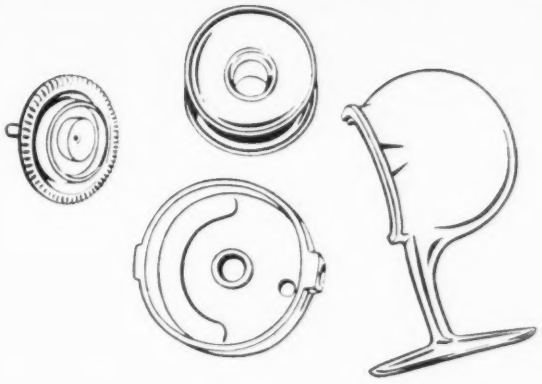
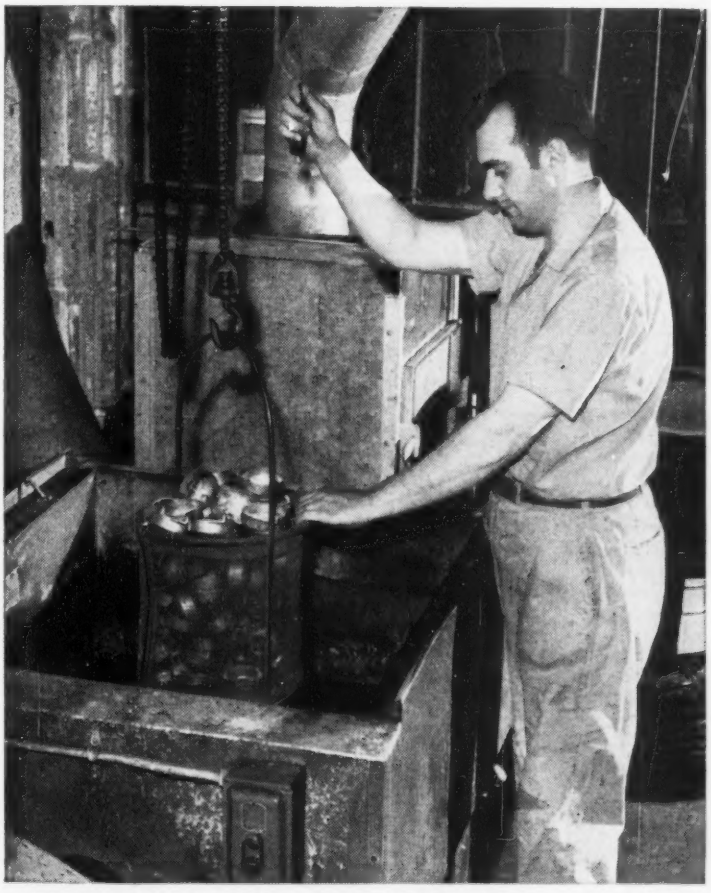
Another field report on "TRICLENE"® D



HIGHLY POLISHED PARTS of the Airex spinning reel are made from five different metals. To clean them all quickly and thoroughly takes just a single degreasing operation with All-Purpose TRICLENE D.

AIREX-fishing reel manufacturer-finds: TRICLENE® D gives brighter cleaning... cuts degreasing time in half



BRIGHT, THOROUGHLY CLEAN aluminum-zinc die castings are removed from the vapor degreaser at Airex Manufacturing Co. TRICLENE D is used by Airex to give fast, efficient, trouble-free degreasing.

Airex Manufacturing Co., of Hillside, N. J., uses parts made of five different metals in its popular spinning reel—aluminum, brass, copper, steel and zinc. Many of the parts are highly polished. Originally, some degreasing operations had to be carried out twice to assure thorough cleaning.

When Airex changed to TRICLENE D trichlorethylene, they substantially cut their degreasing time. *In a single operation*, Du Pont's efficient new solvent gives them the thorough, safe, trouble-free degreasing they need. And TRICLENE D cuts maintenance costs, too: Adjustment of solvent pH is no longer necessary... and the time between degreaser cleanouts is now six to eight weeks instead of two.

Locked-in stabilizers give TRICLENE D unsurpassed resistance to *all* major causes of solvent deterioration—heat, light, air, acids and aluminum chloride—yet this rugged solvent contains nothing to harm even delicately machined metal surfaces. TRICLENE D retains its original high purity longer . . . continues to give *brighter cleaning of any metal*, job after job, distillation after distillation. And remember, it costs no more!

FOR MORE INFORMATION about TRICLENE D and how it can bring a new standard of efficiency to your vapor degreasing operation, write to the nearest District Office of the E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

DU PONT
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... THROUGH CHEMISTRY

TRICLENE® D

TRICHLORETHYLENE

avoid costly rejects due to unacceptable coating thickness...

For quality control and acceptance tests, measure thickness of coatings on metals the easy, accurate, non-destructive way, with the . . .

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Widely used by industry and government for accurately measuring the thickness of:

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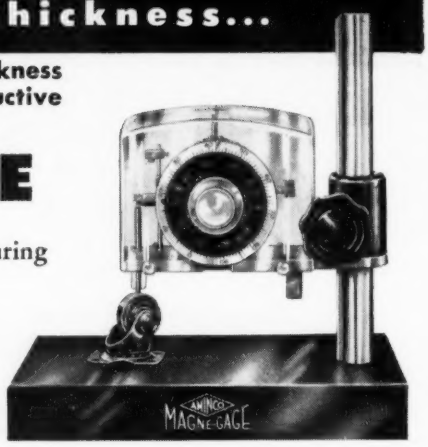
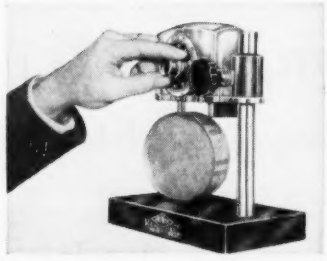
Write for Bulletin 2253-G





Coating on cylindrical object being measured with Magne-Gage

AMINCO Laboratory Instruments

AMERICAN INSTRUMENT COMPANY, INC.

Silver Spring, Maryland • In Metropolitan Washington, D. C.

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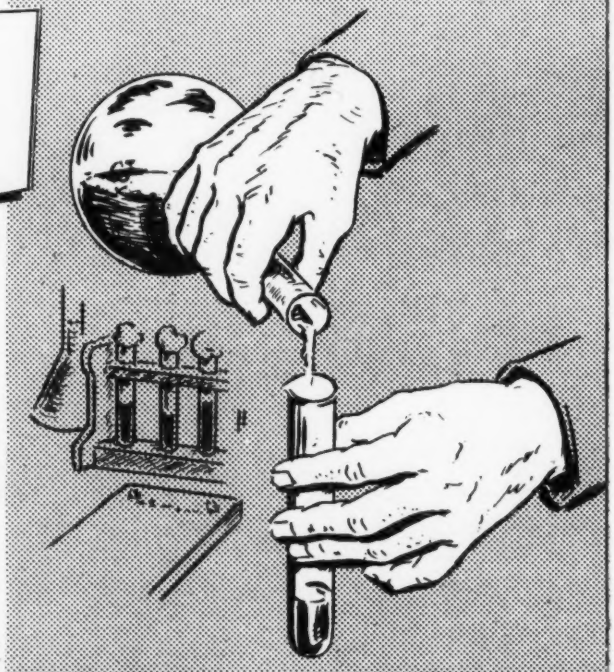
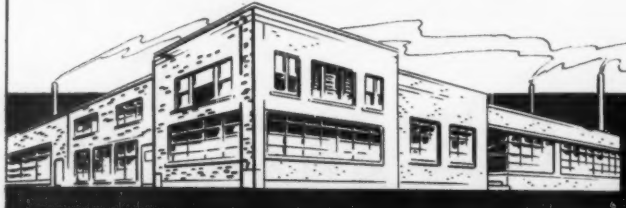
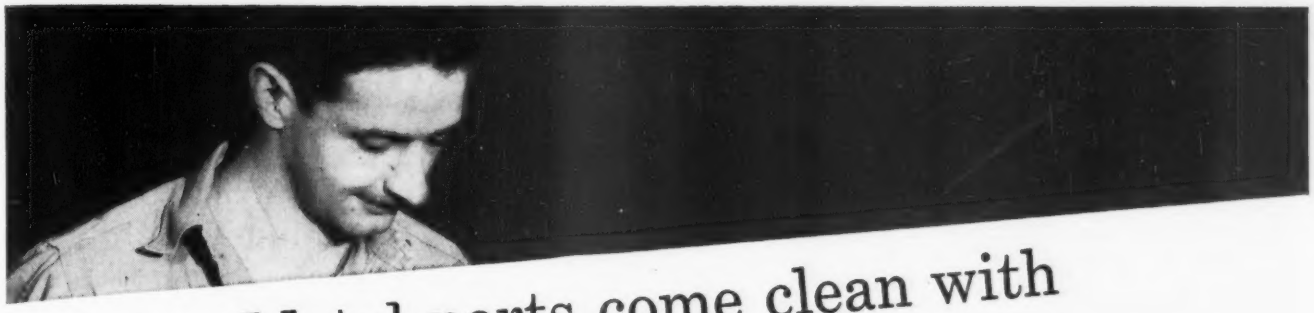




SIGMUND COHN MFG. CO., INC.

121 SOUTH COLUMBUS AVENUE • MOUNT VERNON, NEW YORK



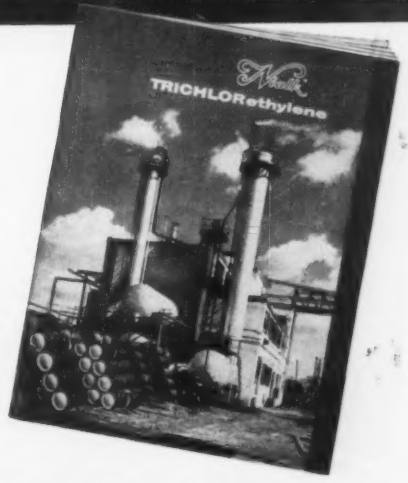
Metal parts come clean with Nialk® TRICHLORethylene

Highest Quality • Re-usable • Economical

Photograph courtesy The Kleer-Flo Co., New York, N. Y.

NIALK TRICHLORethylene is one of the most efficient of all metal cleaning and degreasing agents.

Characterized by a high degree of purity, uniform quality and chemical stability, NIALK TRICHLORethylene is recoverable for re-use. This, coupled with its greater efficiency, makes it doubly economical... assuring you greater cleaning power from every gallon you buy.



Send for free illustrated booklet, NIALK TRICHLORethylene, *containing valuable data on the use and handling of this chemical.*

NIAGARA ALKALI COMPANY

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Plant: Niagara Falls, N. Y.

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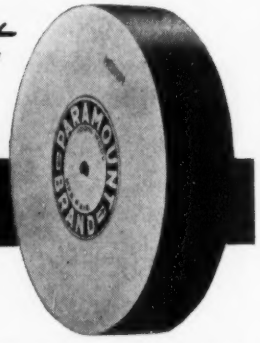
"In jewelry merchandising, fine finishes are all important in catching customers' eyes," reports Shields, Inc., world-famous manufacturer of fine men's jewelry. "We have found that Paramount Felt Wheels can economically produce finishes which meet our standards — *and the customers'*."

Take a tip from Shields, Inc., — make sure the finish on your product is *creating* sales . . . not losing them. Discover how Paramount Felt Wheels can give you better finishes, faster and at less cost. Write, wire or phone today.

Paramount
Felt Wheels, Bobs, Sheet Felt

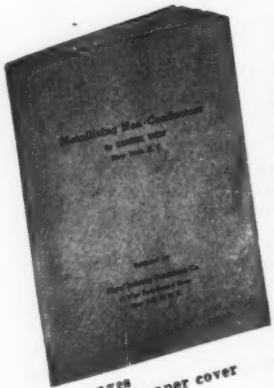


Bacon Felt Co.
437 West Water St., Taunton, Mass.

BOOKS FOR THE PLATER

Metallizing Non-Conductors

By SAMUEL WEIN



61 pages
5½ x 7½ paper cover

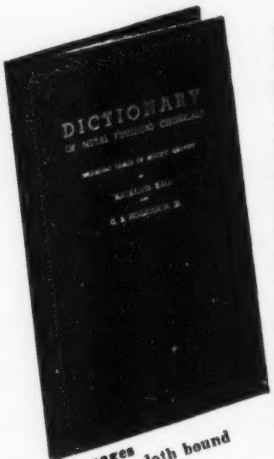
The present work deals with every known method for "metallizing" or the deposition of metals by electrolysis (plating) or non-conductors. It is divided into several sections, i.e., those processes which use chemical, mechanical and physical methods for treatment of surfaces for metallizing. In these groups the specific methods are chronologically reviewed and so the reader can very readily get a better idea of the progress made by the various workers in these arts. At the end is an alphabetical listing of contributors to the art, so that the serious workers can refer to the original sources of the information given in the text by Mr. Wein.

The text is prepared in a practical fashion so that the formulas given will be of material use and is the result of literature collected by the author for more than 25 years and which has been in use by a number of industrial concerns here in the United States and abroad.

PRICE $2.00

Dictionary of Metal Finishing Chemicals

By HALL and HOGABOOM



129 pages
5¾ x 8½ cloth bound

This volume fills the need in the metal finishing field for a handy source of information concerning the chemicals employed. The technical and common names are listed in alphabetical order together with information as to physical appearance, chemical formula, molecular weight, melting and boiling points, and solubility. Available grades, types and sizes of shipping containers are also given, all of which are of help in identifying the contents of unlabelled packages which are found in most plating rooms. A special section contains tables of degrees. Baumé and specific gravity for solutions of a great many salts. Various solutions and dips employed in the finishing department may be easily controlled by the use of a hydrometer and these tables. The authors, editors of the **Plating & Finishing Guidebook** and associate editors of **Metal Finishing**, as a result of their familiarity with the requirements of the industry, have compiled a reference volume which belongs on the shelf of every metal finisher.

PRICE $3.00

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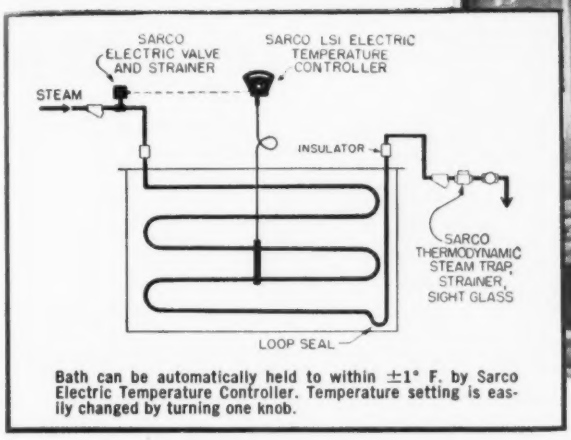

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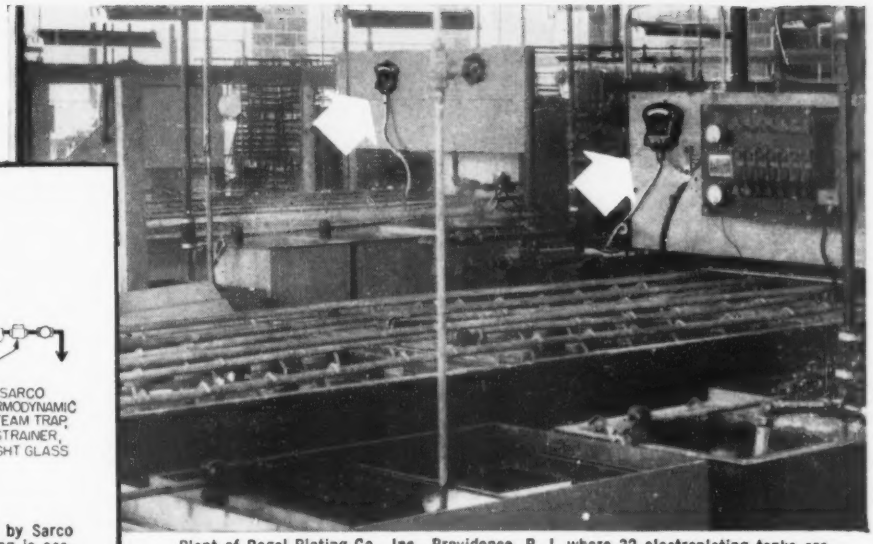

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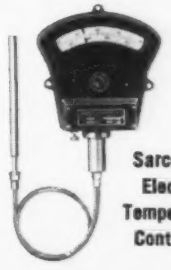

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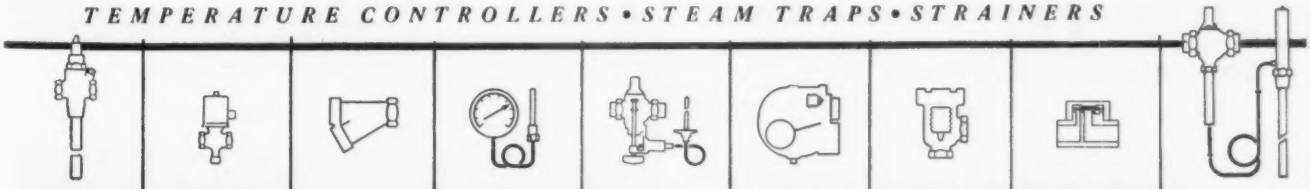

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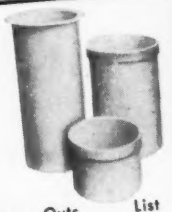

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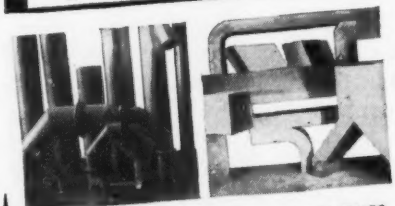
10	12″	20″	24.00	30	18″	28″	49.00
12	12″	24″	26.00	40	18″	36″	59.00
9	10″	24″	23.00	50	18″	48″	69.00
7	9″	24″	21.00	27	22″	18″	49.00
10	16″	12″	26.00	30	22″	20″	53.00
12	16″	14″	28.00	55	22″	36″	70.00
15	16″	18″	33.00	73	22″	48″	83.00
20	16″	24″	40.00	55	28″	22″	76.00
30	16″	36″	49.00	95	28″	36″	98.00
40	16″	48″	59.00	125	28″	48″	125.00



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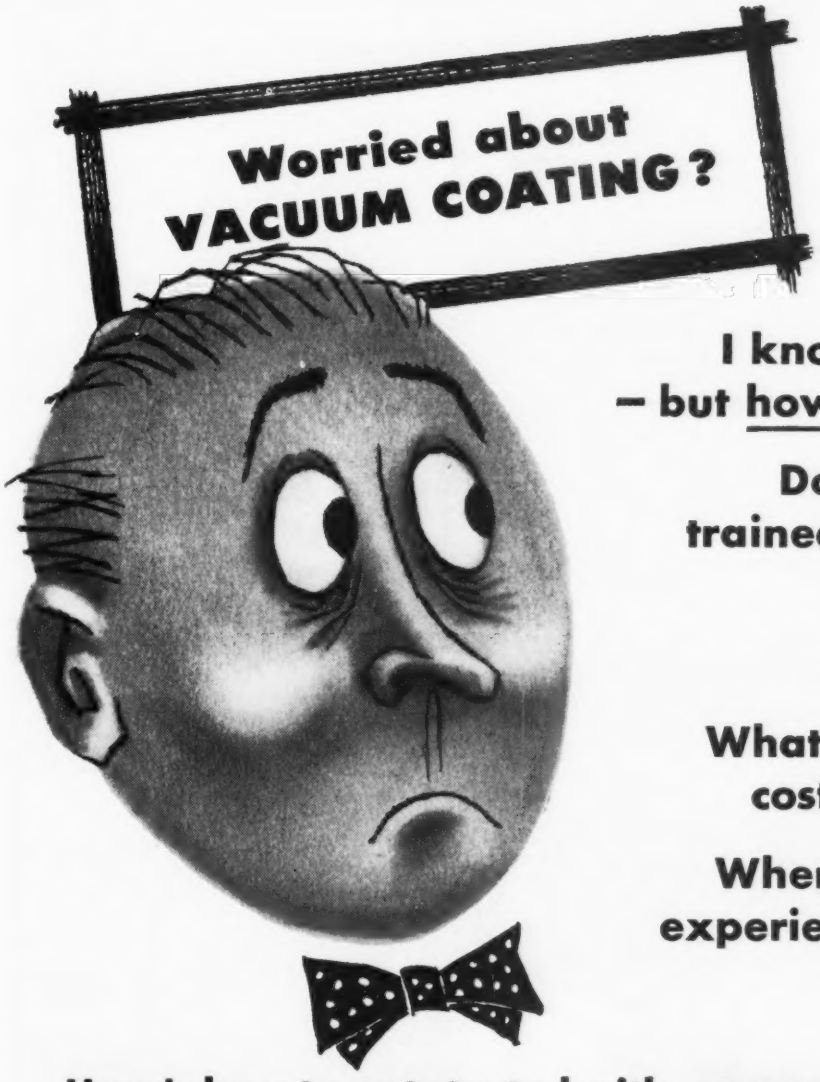

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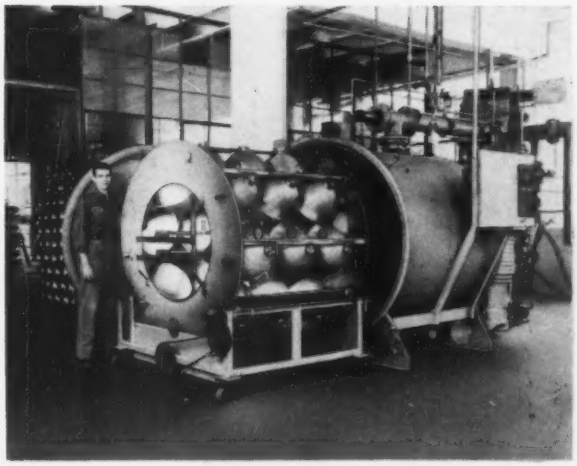

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DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

NOVEMBER, 1955 Volume 53 Number 11

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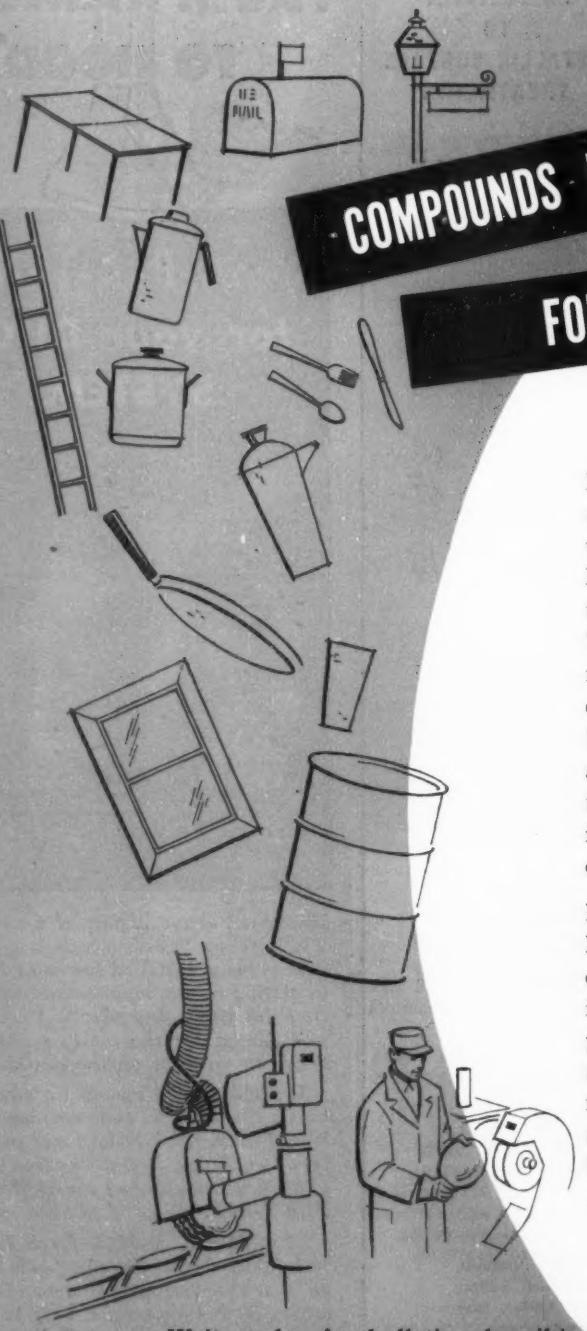

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METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

ESTABLISHED 1903 VOLUME 53 • NUMBER 11 • NOVEMBER, 1955

Each In Its Own Place

The rash of publicity concerning vacuum metallizing as an ornamental finish, which has confronted the reader of industrial and technical magazines in recent months, appears to have had the effect of introducing doubts as to the advisability of future investment in polishing and electroplating equipment. We can understand management's hesitation in the face of claims that sometimes seem to border on the ludicrous to the expert. However, consideration of both methods of finishing should readily point up the obvious conclusion that vacuum metallizing and electroplating each has its sphere of application, and the spheres overlap only very slightly.

The process of vacuum finishing consists, briefly, in applying a coat of lacquer, which seals the base and provides a glossy surface, followed by condensation in a vacuum chamber of a very thin film of aluminum. The metal film is then lacquered for protection. Employing appropriate dyes in the top lacquer film, it is possible to produce an enormous variety of colored, metallic-appearing finishes, including chromium and shades of gold. Equipment costs, which must include lacquer dipping and baking facilities, are roughly comparable to polishing and plating, as are labor costs, aside from polishing and buffing operations.

Obviously, any process which can produce a high finish on raw metals and plastics without buffing offers important economic possibilities but, on the other hand, defects in the surface are not hidden completely, so the finish cannot really simulate a buffed metal surface. Since the vacuum coating is dependent on the quality of the top coat of lacquer for durability, the finish suffers in this respect in comparison with electroplated finishes, which are harder and, unlike dyed lacquers, completely lightfast. Should the protective lacquer on a brass article be worn away or damaged, the surface can be repolished and relacquered. Since the aluminum film on a vacuum coated article is only of infinitesimal thickness, refinishing is out of the question.

These considerations indicate that the vacuum process will find its broadest application on large volumes of cheap articles, such as toys and ornaments, where a high quality surface finish is unnecessary and wear is not a factor. A typical application of this type, in which the process has successfully replaced polishing and plating, is the production of smooth, bright, gold-colored finishes on ladies' belt buckles. The finish on the steel stampings compares very favorably with a hand-buffed brass stamping and is superior in appearance to a ball-burnished stamping, besides being cheaper. On such items electroplating cannot compete but, on the other hand, the vacuum process just won't do on an electric iron or an auto bumper.

Nathaniel Hall

The Structure of Electrodeposited Metals*

By Rolf Weil† and Harold J Read‡

Introduction

THERE is little doubt that several important properties of electrodeposits such as adhesion, appearance, protective qualities, and mechanical properties, are very intricately related to the microstructures of the deposits. It is, therefore, of practical as well as academic interest to study the effect of plating variables on the structure. Although numerous investigations of the microstructure of electrodeposits have been reported in the literature, the microscopic studies consisted almost exclusively of observations of the cross sections of deposits, and fine-grained deposits could not be resolved with the microscopes which were employed. When one attempts to correlate any property of the deposits which depends on the nature of the surface, such as brightness, with the microstructure, it becomes evident that the structure of the as-plated surface rather than the cross-section will be of greatest importance. The electron microscope with its excellent depth of focus provides a means for examining as-plated surfaces without metallographic preparation, and the high resolving power of the instrument makes it possible to study structures which are too fine for ordinary microscopes.

In spite of the voluminous literature on the structure of electrodeposits, a systematic study of the effect of plating variables on the structures of several electroplated metals has never been reported. An extended review of about 100 references which pertain to the structure of electrodeposits can be found in the thesis upon which this paper is based. A few of the more pertinent contributions will be cited in the discussions which will be presented below. In most instances the effects of one or two plating variables on the structure of a single deposited metal were studied and, because of the use of different plating baths by various investigators, the results from several papers cannot be integrated to provide a comprehensive picture. In many instances the purity of the plating baths, the plating conditions, or other important variables were either neglected or inadequately described in the publications. A systematic investigation of the effect of plating variables on the structure of different electroplated metals is therefore indicated.

It was necessary to assign some limits to the scope of the proposed investigation, and in view of the paucity of information on the *surface* structure of unpolished, unetched deposits, studies with an electron microscope were underwritten in this direction. It was necessary also both to limit the metals to those which are extensively deposited and to limit the plating conditions which were to be varied to those which are most important in operating practice, namely, current density, temperature and, where applicable, pH. Even within these limitations a large number of specimens and a great deal of delicate microscopy were required to establish with certainty the information reported herein.

Experimental Procedure

Electrodeposited specimens of nickel, copper, zinc, cadmium, and cobalt were prepared from commercial baths or from analogous solutions which were prepared for special purposes. Cobalt, of course, does not fall into the category of commonly plated metals but it was included in this work for reasons which will appear later. Specimens of each metal were plated under all combinations of the following variables: room temperature and an elevated temperature (55°C., 131°F.), at a low current density (0.5 amp./dm.^{2}, 4.6 amp./ft.^{2}) and at a high current density (5.0 amp./dm.^{2}, 46 amp./ft.^{2}) and, where applicable, at a low pH (1) and at a relatively high pH (4).

Some of the baths which were used are very decidedly not commercial baths; for example, the acid cadmium bath is never to our knowledge used commercially, but it is analogous to the acid zinc bath and was used herein for a specific reason which will appear later. The compositions of all of the plating solutions were as follows:

---

*Condensed from a thesis submitted by Rolf Weil to the Graduate Faculty of the Pennsylvania State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in metallurgy. The complete thesis (164 pages) is available from University Microfilms, Ann Arbor, Mich.

†Present address: Argonne National Laboratory, Metallurgy Division, P. O. Box 5207, Chicago 80, Ill.

‡Professor of Physical Metallurgy, Pennsylvania State University, University Park, Pa.

ALL-SULFATE NICKEL BATH:

$NiSO_4 \cdot 7H_2O$	332 g./l.	(44 oz./gal.)
H_3BO_3	30 "	(4 ")

ALL-CHLORIDE NICKEL BATH:

$NiCl_2 \cdot 6H_2O$	298 g./l.	(40 oz./gal.)
H_3BO_3	30 "	(4 ")

WATTS NICKEL BATH:

$NiSO_4 \cdot 7H_2O$	319 g./l.	(42.5 oz./gal.)
$NiCl_2 \cdot 6H_2O$	45 "	(6 ")
H_3BO_3	30 "	(4 ")

ALL-SULFATE COBALT BATH:

$CoSO_4 \cdot 7H_2O$	332 g./l.	(44 oz./gal.)
H_3BO_3	30 "	(4 ")

ALL-CHLORIDE COBALT BATH:

$CoCl_2 \cdot 6H_2O$	298 g./l.	(40 oz./gal.)
H_3BO_3	30 "	(4 ")

WATTS COBALT BATH:

$CoSO_4 \cdot 7H_2O$	319 g./l.	(42.5 oz./gal.)
$CoCl_2 \cdot 6H_2O$	45 "	(6 ")
H_3BO_3	30 "	(4 ")

ACID COPPER BATH:

$CuSO_4 \cdot 5H_2O$	200 g./l.	(27 oz./gal.)
H_2SO_4	50 "	(6.7 ")

CYANIDE COPPER BATH:

NaCN	35 g./l.	(4.7 oz./gal.)
CuCN	26 "	(3.5 ")
Na_2CO_3	30 "	(4 ")
Rochelle Salt	30 "	(4 ")

ACID ZINC BATH:

$ZnSO_4 \cdot 7H_2O$	280 g./l.	(37 oz./gal.)
$Al_2(SO_4)_3 \cdot 18H_2O$	35 "	(4.7 ")
NH_4Cl	18 "	(2.4 ")

CYANIDE ZINC BATH:

NaCN	42 g./l.	(5.6 oz./gal.)
$Zn(CN)_2$	60 "	(8 ")
NaOH	78 "	(10.5 ")

ACID CADMIUM BATH:

CdO	125 g./l.	(16.7 oz./gal.)
H_2SO_4	52 "	(6.9 ")
$Al_2(SO_4)_3 \cdot 18H_2O$	35 "	(4.7 ")
NH_4Cl	18 "	(2.4 ")

CYANIDE CADMIUM BATH:

CdO	39 g./l.	(5.2 oz./gal.)
NaCN	131 "	(17.5 ")

A small Lucite vessel was used for all plating operations and was immersed in a constant-temperature water bath for the runs at elevated temperature. The cathode was held in a Lucite frame which was constructed so that an area of 0.1 dm.^{2} (1.6 in.^{2}) was exposed to the solution. High-purity soluble anodes, which were enclosed in Vinyon bags to prevent solids from entering the solution, were used in all cases. The bath was not agitated during the plating operation but was thoroughly stirred between runs. The pH was checked frequently and was adjusted when necessary, but no analyses were performed on the solutions because of the relatively small amount of metal which was deposited from any given batch of electrolyte. All of the solutions were purified by the most widely accepted conventional methods and, in no case, was trust put in supposedly pure starting materials.

In all cases the cathode was a rolled-copper sheet 0.005" thick which had been electropolished in phosphoric acid to the point where it showed no structure at a magnification of 10,000X in the electron microscope. The polished cathodes were prepared for electroplating according to accepted practices and all deposits were firmly adherent.

In most cases a series of deposits of increasing thickness was made for each set of plating conditions for a given metal, starting at a thickness of 0.003 mil and progressing in a geometric series to 0.63 mil. As a result of an extended study of the change of surface microstructure with thickness it was found that no changes occurred, at least so far as classification was concerned, after a thickness of 0.16 mil was attained. The size of the structural features might vary at greater thicknesses but the character did not. Most of the electron micrographs reproduced herein were made, therefore, from specimens whose thickness was approximately 0.16 mil. The thickness of the heavier deposits was determined by weighing a sample of known area and calculating the thickness from the weight, area, and published densities for the various metals. For specimens whose thickness was less than 0.16 mil thickness values were obtained from the linear relationship between plating time and thickness as established by measurements on the thicker specimens.

The electron microscope was used almost exclusively for the determination of the microstructures of the deposits. In the electron microscope it is necessary to pass through the specimen a beam of electrons which is eventually used to form an image on a fluorescent screen or photographic plate. Unless a metallic specimen is exceedingly thin (a few microinches) it is opaque to an electron beam, and it is necessary, therefore, to examine a replica of the specimen rather than the metal itself. The techniques for the preparation of such replicas have been well established, and widely accepted methods were used in the present work. It was found that collodion was the most satisfactory replica material for the electrodeposited metals. The strength and contours of the replica were accentuated by shadowing with evaporated chromium, again according to widely accepted techniques.

Weil and Read[1] have shown that extremely thin metallic specimens can be examined directly in the electron microscope by a technique which they have called electron microradiography. They have shown also how suitable film can be prepared by electrodeposition. Inasmuch as the electrodeposits reproduce the microstructure of the basis metal for at least a small thickness, a very thin layer of a second metal plated on an electrodeposit would be equivalent, so far as microstructure is concerned, to a layer of the original electrodeposit of the same thickness. If the original deposit is then dissolved selectively from the thin plate

Fig. 1. (left) Electron micrograph showing structure type IA-1, all-sulfate nickel bath, 0.5 amp./dm.^{2}, pH 1.0, 55°C. 15,000X.

Fig. 2 (right) Electron micrograph showing structure type IA-2, Watts nickel bath, 5.0 amp./dm^2, pH 4.2, 55°C. 15,000X.

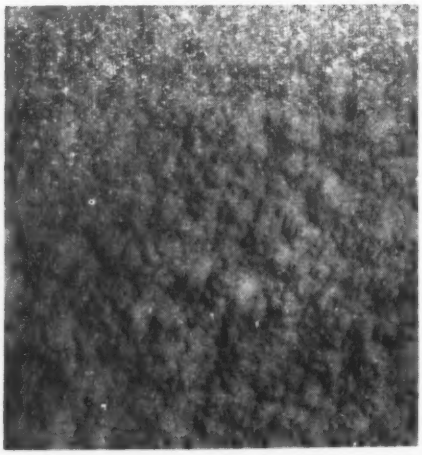


Fig. 3 (left) Electron micrograph showing structure type IB, all-sulfate cobalt bath, 5.0 amp./dm.^{2}, 1.0 pH, 25°C. 20,000X.

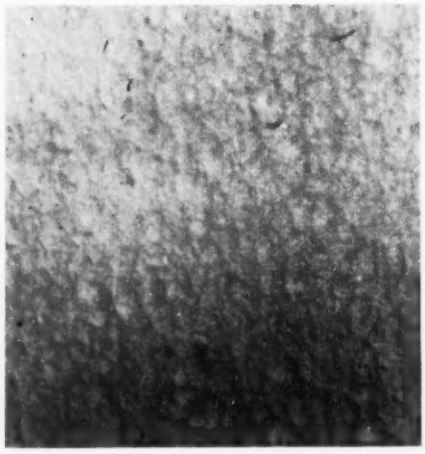


Fig. 4 (right) Electron micrograph showing structure type IB-4, Watts nickel bath, 5 amp./dm.^{2}, pH 4.2, 25°C., 2.5 $\times$ 10^{-5} cm. thick). 15,000X.

Fig. 5 (left) Electron micrograph showing structure type IB-5, all-sulfate nickel bath, 5.0 amp./dm.^{2}, pH 4.2, 25°C. 15,000X

Fig. 6 (right) Electron micrograph showing structure type IC, acid copper bath, 0.5 amp./dm.^{2}, 55°C. 7,500X.

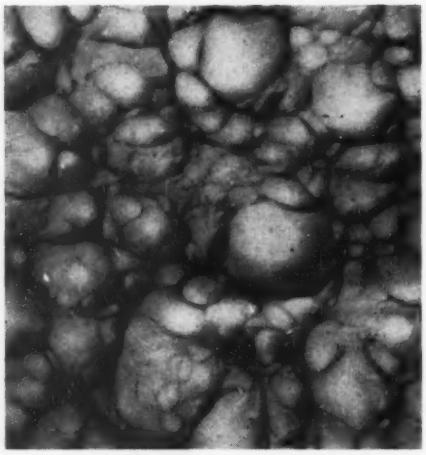


Fig. 7 (left) Electron micrograph showing structure type ID, all-chloride nickel bath, 0.5 amp./dm.^{2}, pH 4.2, 55°C. 15,000X.

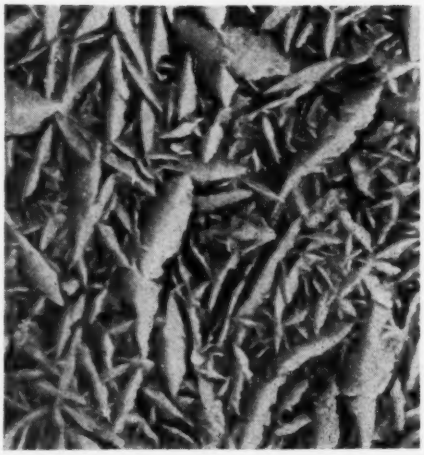


Fig. 8 (right) Electron micrograph showing structure type IIA-6, all-chloride nickel bath, 0.5 amp./dm.^{2}, pH 4.2, 25°C. 15,000X.

Fig. 9. (left) Electron micrograph, all-chloride cobalt bath. 5.0 amp./dm.^{2}, pH 4:1, 25°C., 4×10^{-4} cm. thick. 15,000X.

Fig. 10. (right) Electro micrograph, Watts nickel bath, 5.0 amp./dm.^{2}, pH 2.0, 55°C., 7×10^{-6} cm. thick. 15,000X.

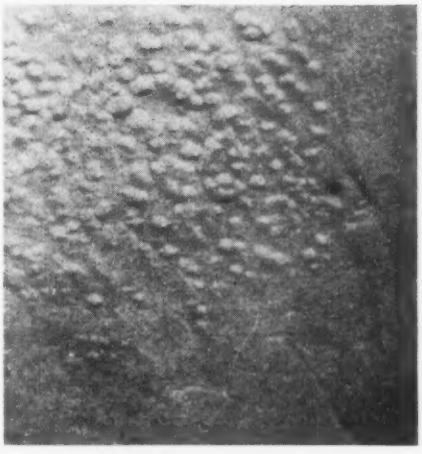


Fig. 11. (left) Electron micrograph, Watts nickel bath, 5.0 amp./dm.^{2}, pH 2.0, 55°C., 12×10^{-5} cm. thick. 15,000X.

Fig. 12. (right) Electron micrograph, Watts nickel bath, 5.0 amp./dm.^{2}, pH 2.0, 55°C., 25×10^{-5} cm. thick. 15,000X.

Fig. 13. (left) Electron micrograph, Watts nickel bath, 5.0 amp/dm.^{2}, pH 2.0, 55°C., 5×10^{-5} cm. thick. 15,000X.

Fig. 14. (right) Electron micrograph, Watts nickel bath, 5.0 amp./dm.^{2}, pH 2.0, 55°C., 1×10^{-4} cm. thick. 15,000X.

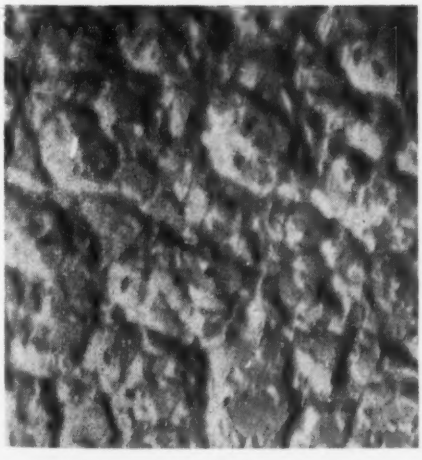


Fig. 15. (left) Electron micrograph, Watts nickel bath, 5.0 amp./dm.^{2}, pH 2.0, 55°C., 2×10^{-4} cm. thick. 15,000X.

Fig. 16. (right) Electron micrograph, all-chloride nickel bath, 5.0 amp./dm.^{2}, pH 5.2, 55°C., 1×10^{-4} cm. thick. 15,000X.

TABLE I

Microstructure Classification, Eye Evaluation of Deposited Surface, Lattice Structures

	Nickel			*Cobalt*								
Plating Conditions	*All-sulfate Bath*	*Watts Bath*	*All-chloride Bath*	*All-sulfate Bath*	*Watts Bath*	*All-chloride Bath*	*Zinc Sulfate Bath*	*Cadmium Sulfate Bath*	*Copper Sulfate Bath*	*Copper Cyanide Bath (pH—12.5)*	*Zinc Cyanide Bath*	*Cadmium Cyanide Bath*
0.5 amp./dm.^{2} pH 1.0 25°C.	IA-2 Semi-bright	IA-2 Semi-bright	IB-5 Matte fcc & possibly hcp	IB-4 Bright	IB-3 Matte	ID Dull, gray fcc & hcp	IC Shiny, crystalline	IC Shiny, crystalline, pink	IC Shiny, crystalline	IB-4, 5 Matte	IC Shiny, crystalline	IIB-7 Matte
0.5 amp./dm.^{2} pH 1.0 55°C.	IA-1 Semi-bright fcc	IA-2 Semi-bright	IB-5 Matte	IIA-7 Dull fcc & hcp	IIA-7 Dull, gray fcc & hcp	IB-5 & IIA-6 Matte	IC Shiny, crystalline	IC Shiny, crystalline, pink	IC Shiny, crystalline	IB-4, 5 Matte	IC Shiny, crystalline	IIB-7 Shiny, crystalline
0.5 amp./dm.^{2} pH 4.0 25°C.	IB-5 Semi-bright	IA-1 Semi-bright	IIA-6 Dull, gray fcc & hcp	IIA-7 Dull fcc & hcp	IIA-7 Dull, gray	IB-5 & IIA-6 Matte fcc & hcp	IC Shiny, crystalline	IC Shiny, crystalline, pink	IC Shiny, crystalline	IB-4, 5 Semi-matte	IIB-6 Matte	IIB-7 Semi-matte
0.5 amp./dm.^{2} pH 4.0 55°C.	IB-5 Semi-bright fcc	IA-1 Semi-bright	ID Dull, gray fcc & possibly hcp	IB-5 Bright	IA-1 Matte fcc & hcp	IB-4 Semi-bright fcc & hcp	IC Shiny, crystalline	IC Shiny, crystalline, pink	IC Shiny, crystalline	IB-5 Semi-matte	IIB-6 Matte	IC Matte
5.0 amp./dm.^{2} pH 1.0 25°C.	IA-1 Semi-bright fcc	IA-2 Semi-bright	IB-4 & IIA-6 Matte	IB-3 Bright fcc & hcp	IB-3 Bright fcc & hcp	IB-4 Matte	IC Shiny, crystalline	IC Shiny, crystalline, slightly pink				
5.0 amp./dm.^{2} pH 1.0 25°C.	IA-1 Semi-bright	IB-5 Semi-bright	IB-5 & IIA-6 Matte fcc & hcp	IB-4 Matte	ID Matte	IIA-7 Dull, gray	IC Shiny, crystalline	IC Shiny, crystalline, slightly pink				
5.0 amp./dm.^{2} pH 4.0 25°C.	IB-5 Semi-bright	IA-1 Semi-bright	IB-5 & IIA-6 Matte fcc & hcp	IB-5 Matte	IA-1 Matte	IIA-7 Dull, gray	IC Shiny, crystalline	IC Shiny, crystalline, slightly pink				
5.0 amp./dm.^{2} pH 4.0 55°C.	IB-5 Semi-bright	IA-2 Semi-bright fcc	IIA-6 Dull, gray fcc & hcp	IIB-5 & IIA-6 Dull	IB-5 & IIA-6 Matte fcc & hcp	IA-3 Bright	IC Shiny, crystalline	IC Shiny, crystalliine, slightly pink				

of the second metal, the latter can then be used directly in the electron microscope as a specimen which, so far as electron microradiography is concerned, will reveal the structure of the original deposit. It is necessary, of course, to find a suitable solvent which will take the original deposit into solution with no attack on the exceedingly thin film of the second metal. Electron microradiography was used to check the collodion replica technique and to clarify certain structural features which were not clearly shown by collodion replicas. Electron microradiography is often of great assistance in those cases where it is not possible to prepare collodion replicas owing to difficulties in stripping the collodion from the surface being examined.

Although the major portion of the investigation was devoted to the study of visual microstructures, the lattice structure of some representative nickel and cobalt specimens was determined. Owing to the thinness of the deposits, it was necessary to use electron diffraction techniques rather than X-ray methods.

Experimental Results

The surface microstructures of the metals electrodeposited under the various plating conditions previously described can be divided into two major types.

Type I includes those structures in which the individual crystals do not possess a distinct preferred growth direction in the plane of the surface. Type I may be further divided into four types of textures. Surfaces which consist of large, rather smooth areas with regions of fine grains between them are called type IA. Structures of uniform, fine grains are classified as type IB. Textures which on visual observation appear quite crystalline and which under the electron microscope show large grains with a definite platelet structure comprise type IC. The platelet structure is characterized by parallel lines over a grain area. The lines are often fine and may not show distinctly in printed halftones, even though they were unmistakable on the original photographs. The designation type ID is given to those surfaces that have small, uniform, domeshaped grains. Figs. 1 and 2 show type IA structure; Figs. 3, 4 and 5 are representative of type IB; Fig. 6 shows type IC; and Fig. 7 presents an example of type ID.

Type II comprises those structures in which the individual crystals have a definite preferred direction of growth in the plane of the surface. This class is subdivided into two types. Type IIA is represented by the acicular structures shown in Figs. 8 and 9. Type IIA either has platelets perpendicular to the preferred direction, or shows no platelets at all. In type IIB the platelets are parallel to the preferred growth direction. The structures of type IIB will be discussed later.

In addition to the general classification of the microstructures, it is often desirable to designate the particle size. Type IA is divided into two sizes. Surfaces mainly composed of fine grains are size 1, and those principally composed of plane areas or large grains are size 2. Fig. 1 represents size 1 and Fig. 2, size 2. Type IB is divided into three sizes. Size 3 is shown in Fig. 3, size 4 in Fig. 4, and size 5 in Fig. 5. Types IC and ID did not vary sufficiently in grain size to warrant subdivision. Type III structures are also divided into crystal sizes. Size 6 is shown in Fig. 8, and size 7 is represented by Fig. 9.

The classifications of the various deposits together with electron-diffraction data and a visual evaluation of the as-plated surfaces are given in Table I.

The results shown in Table I can be better understood if the development of the various types of structure, as seen by a study of the change of microstructure with increasing thickness, is considered first. The surface structures of deposits whose thickness increased according to a geometric series were examined electron microscopically. Each photograph represents a step in the development of the final deposit because the structures obtained at a given thickness and deposited under the same plating conditions are comparable. Figs. 10-15 show the development of a type IB structure nickel deposited from a Watts bath. It is evident that the structure of the thinnest deposit deviates only slightly from that of the smooth copper basis metal in that a few large grains have formed. The platelet structure can be seen within the grains and also at the boundaries. This is the structure called IA. As the deposit grows, the uniform-grained structure, type IB, is obtained. It is thus seen that type IA is an intermediary step in the development of IB. The sequence of structures shown in Figs. 10-15 is representative of the Watts nickel bath and also of the all-chloride nickel bath under the plating conditions leading to the type IB structure.

The growth of the acicular structure in the all-chloride nickel bath at first is identical to that of the type I structure, showing the development of fine grains and platelets. As the deposit becomes thicker, a mixed structure shown in Fig. 16 is formed, which then changes into the acicular type. It can be deduced from this study that the mixed structure is also a step in the development of the acicular structure. The other mixed structures obtained into the all-chloride nickel bath at greater thicknesses showed the same electron-diffraction pattern as the specimen pictured in Fig. 16. It should not be assumed, however, that the mixed structure will always change into an acicular structure as the thickness increases. Deposits which were of the mixed type at 0.16 mil thickness had the same structure at a thickness of 2 mil in every instance, again showing that the structural type does not change after the thickness has grown 0.16 mil.

The acicular structure in cobalt does not always develop in the same manner as that in nickel. Even thin cobalt deposits have needle-like constituents which become larger as the deposits become thicker. The coarse needles of such deposit shown in Fig. 9 indicate that the acicular structure is composed of platelets which are perpendicular to the long axis.

Another interesting case history of structure development is found in the type IC deposits which are obtained from a zinc sulfate bath. It was observed that the platelet size as well as the grain size increases with thickness. The type IC structure in deposits from an acid copper bath passed through types IA and IB in its development. With the manner of growth of the various structural types in mind, the results shown in Table I can now be discussed.

(*To be continued next month*)

Finishing Pointers

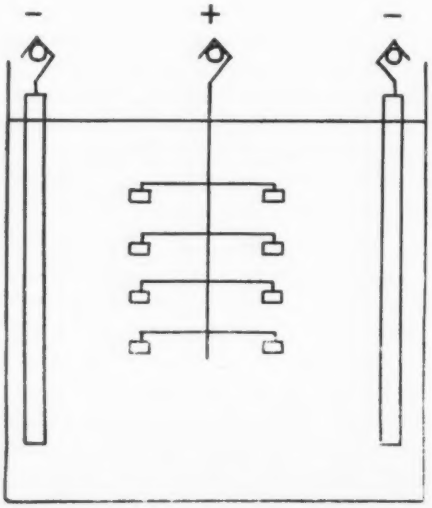
Stripping of Tin from Copper-base Alloys

TIN can be stripped from copper, brass, or bronze by a number of methods given in the METAL FINISHING GUIDEBOOK. The selection of a method depends on the urgency of the situation, the chemicals available, the amount of work to be stripped and the time allowable for stripping.

A production situation arose where it became necessary to strip and replate a large number of tin plated bronze parts. Since this was to be done on a fairly large scale a method was sought that would be rapid and easily controlled.

It was decided to try electrolytic stripping, since the stripping rate would be dependent on the electrolysis. Stripping with a hot sodium hydroxide solution was tried and was successful, but was too slow. It was then decided to try acid stripping. Hydrochloric acid was tried and was immediately successful. This method is interesting in that it can be used as a general method where a base metal is deposited on a noble metal.

The stripping bank was a simple electrolytic tank as shown with carbon cathodes and the work as anodes. The concentration of hydrochloric acid was not critical. A concentration of 7 to 15 oz./gal. HCl was used, although wider limits are usable. The tin thickness was about 0.1 mil. At a controlled anode current density of 30 A.S.F. the tin could be stripped in 1 to 2 minutes. The only difficulty was that it was necessary to watch the work. With this stripping method the current will concentrate on the base metal being stripped and will not attack the noble metal appreciably until the base metal is gone. However after the base metal is stripped the current will then dissolve the noble metal at high anode efficiency. Also, the current will concentrate on edges and corners and possibly cause an undesirable loss in size of the part. Slow stripping and observation for the completion of stripping is desirable to obtain complete stripping with a minimum of attack on the underlying metal. On the other hand more rapid stripping is possible and was used in this case.



After the process had been used for several days stripping was tried at line voltage, which was 6 volts. Due to high conductivity of the acid, the current density was 300 to 500 A.S.F. and the tin was stripped in 5 to 10 seconds. Because of the color contrast between tin and copper the completion of stripping could be readily observed. Also, the stripping was stopped as close to completion as possible. A few pieces were not completely stripped and these were merely placed on the next rack where they were readily stripped and protected as long as other pieces were being stripped. This stripping bath had a relatively long life and required very little control.

The method was not used for other combinations of metals but should be useful where the deposit is anodic with respect to the basis metal. The method is certainly a possibility for rapid stripping of zinc and cadmium from steel or for stripping of tin, cadmium, zinc, lead, chromium, and nickel from copper or silver alloys. Hydrochloric acid should be a good general electrolyte, since the chlorides of the metals are highly soluble.

Sulfuric, fluoboric, acetic and other acids may be used as an electrolyte. Offhand, one would not tend to use a method where the basic metal would be readily attacked by the electrolyte. This objection is valid, but the attack can be held to a practical minimum by carefully observing the stripping rate.

The method is not limited to thin deposits. While the method was being used, the platers also began to use it for stripping tin from copper plating racks. By having the stripper handy to the plating line the plating racks could be stripped frequently and build-up of deposit could be held to a minimum. The racks were thus kept more free of plate and there was less trouble with robbing of the pieces during plating due to heavy nodular deposits.

There were two precautions to be observed in connection with high speed stripping in a hydrochloric acid electrolyte. First, if it is done on a large scale, the cathodic spray is obnoxious. Consequently, the tank should be hooded. If the stripping time is short and the quantity small this precaution will not be necessary. Second, heavy currents will result at line voltages. This will result in heating of racks suspended from the anode bar unless the hooks are sufficiently heavy. This is not a serious problem but it is a possible source of a bad burn if it is not kept in mind.

Stripping methods are not common and well controlled processes where they are used for salvage work. They may be used for a few pieces or for a great many pieces but, when the trouble that caused the salvage to be necessary is corrected, the stripping method is abandoned. The method is then only a memory or a record for possible future use.

When salvage work is necessary to recover lost values or to keep production rolling, a stripping bath becomes an important step in the plating line. The electrolytic stripping of base metals with hydrochloric acid is a good general method to have on tap.

Continuous Hot Galvanizing of Strip

Advanced Techniques for Tight Coating Applied at Wheeling Steel

By Nelson E. Cook, *General Sup't. Galvanizing Operations, Wheeling Steel Corporation, Wheeling, W. Va.*

FROM the very inception of the art of galvanizing, many thousands of methods and processes have been used to attempt to obtain the maximum service from the zinc coated article. And, during all these years, the practice of applying zinc coatings to iron and steel has been an "art" in the truest sense of the word.

In order for zinc coatings to be most effective, it is essential that the iron or steel be completely and continuously coated with an even layer of the zinc metal, for the continuity and uniformity of the coating is much more important than the total weight of zinc coating on the article. To be most effective, the coating should be as pure as possible, and it should be as free as possible of the iron-zinc alloy layers which cause peeling of the coating in weathering or forming of the material. Anything that can be done in applying the zinc coating which will make the coating at least equal in ductility to the ductility of the base to which it is applied will make the zinc coated material more adaptable to more uses.

It was not until the advent of the Cook-Norteman process, that the production of tight coat galvanizing was brought to a state of perfection which now assures the most efficient utilization of zinc as a protective metal. This process, making use of many new and unique technical procedures, has so simplified the process of tight zinc coating that the control of adhesion is localized in one part of the process, in the pot area itself, the only place where positive control and regulation can satisfactorily be accomplished. Since this has now been accomplished, it is possible to produce tight zinc coatings on all types of steel base, irrespective of the properties of the base. No longer is it necessary to concern ourselves with the chemical, physical, or surface properties of the base material. Whether or not the material is annealed or unannealed is of no concern. The only major requirement of the process is that the material be fairly well cleaned in some manner before it reaches the coating area.

Figure 1. View of the entrance end of the line, showing the coil of black material paying off into the line. Also shown is the welder for welding one coil to another, the side trimmer, and the strip entering the first looping pit.

Figure 2. In these surface preparation tanks, the strip may be given an acid or alkali treatment, or a combination of both, each one followed by rinsing and scrubbing with Tampico brushes.

In the coating area there are really two control centers, both of which are most important in the production of the optimum in tight zinc coatings. First is the coating bath itself. The Wheeling process takes advantage of a long known fact that small percentages of aluminum, when thoroughly mixed with the zinc metal in the coating bath, will suppress the brittle iron-zinc alloy layers which normally would be formed.

In order for the aluminum to be effective, the zinc and aluminum must be completely and continuously mixed at all times. Especially is this true at the point of first entrance of the steel article into the coating bath. If the aluminum is not completely effective at

that point, alloy layers will start to form, and will grow, and any amount of aluminum which is put into the mix in the remainder of the bath is of little effect. The reason for the effectiveness of aluminum is thought to be due to the fact that aluminum has a greater affinity for iron than it does for zinc, and the aluminum will tend to take away from the article being coated any iron which would normally unite with zinc to form iron-zinc alloys.

Wheeling was the first to use induction heated, ceramic lined pots for containing the coating metal, and the direct induction heating in the bath, automatically controlled so that the induction heating is working at all times, regardless of the gauge or speed of the material which passes through the pot, induces thermal circulation of the zinc and aluminum throughout all the bath through which the work to be coated is passed.

Figure 3. The liquid flux is applied in the tank at the extreme right of the picture. The strip then passes vertically through a set of controlling rolls and brushes which regulate the thickness of film of the flux automatically, regardless of the speed of travel of the strip. The strip then passes upward through the first leg of the drying and preheating oven. In this leg the moisture is bled off and the temperature of the strip is raised to approximately 250°F. The strip then is turned over rolls at the top and travels downward vertically through the second leg of the preheating oven and the temperature is raised to 350-500°F. before the strip is entered into the coating bath. The drying system is a conduction system, automatically controlled to match strip speeds and gauges.

It has been found that the tightness of the zinc coating is directly proportional to the amount of iron in the finished coating. Therefore, by simple titration of a sample of the finished coated material, the quality of the coating can be quickly determined. If it is desired to vary the amount of iron in the coating, a predetermined amount of aluminum is simply added, introduced directly into the inductor throat, where it melts immediately and mixes into the metal in the main bath by thermal circulation.

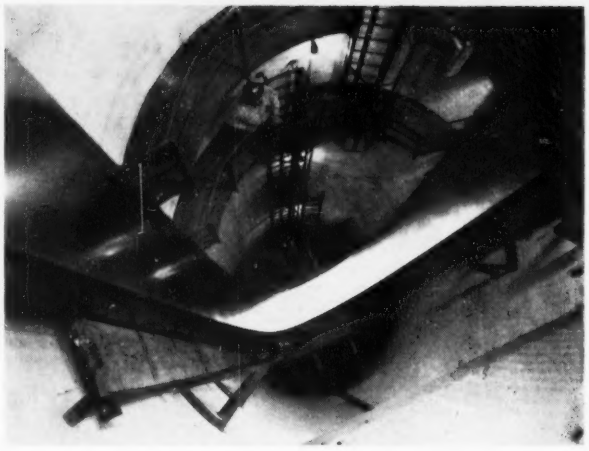
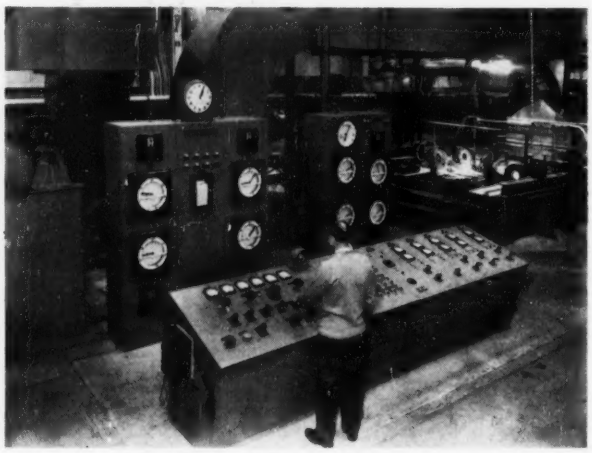


Figure 4. View of one of the two looping pits in the line. The pit at the entrance of the line provides storage of material sufficient to give time for welding one coil to another without stopping the processing section of the line. A similar pit at the exit of the line gives space for storage of material while changing sheared lengths, changing coils, etc., without stopping the processing section of the line.

With such a simple and positive control of the process, the composition of the metal bath itself is no longer of prime importance, since the important thing is the composition of the coating on the finished product. No consideration need be given the numerous types of alloy layers, about which so much has been written in the past, since the total amount of iron in the coating is much more important than what kind it is. These simplified procedures, the result of being able to mix aluminum with zinc under any con-

Figure 5. The galvanizing pot, in view of the operator at the main control desk, contains the molten zinc which is kept at operating temperature (approx. 850-860°F.) by electrical induction heating units. This ceramic lined pot is the largest yet built for this purpose. Sink rolls and coating rolls are installed in the rig to guide the strip smoothly through the galvanizing bath. Upon leaving the coating rolls the strip travels vertically and is contacted on both sides by blasts of cooling air which cool the coating sufficiently to prevent pickup of zinc by the next contact roll. At the extreme left of the picture the strip is seen returning to floor level around the roll after having passed through the cooling section of the line (overhead) to bring the temperature of the coated sheet to 200° or lower.



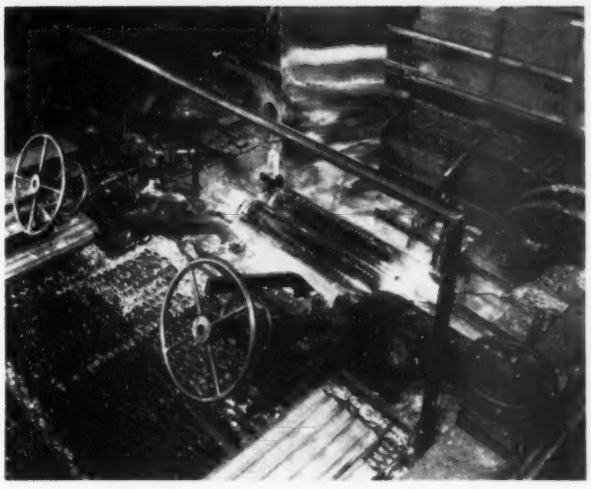


Figure 6. Close-up view of the galvanizing pot, showing the coated strip emerging upward vertically from the coating rolls. These coating rolls are one of the important means of regulating thickness of the zinc coatings which are to be applied.

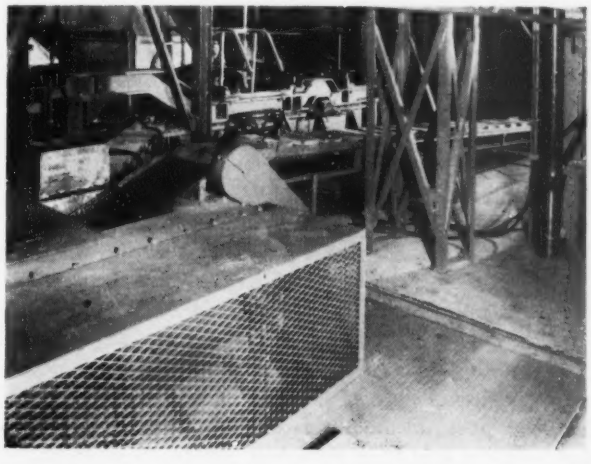
ditions of operation, now make it possible to guarantee that zinc coatings will adhere to the steel base, thus giving the maximum protection.

The second control center, in the coating area, is one which is equally important in the production of tight zinc coatings. This is the prefluxing and preheating area. The process of prefluxing material to be coated in a zinc bath containing aluminum has been tried many times and abandoned until the advanced procedures were developed.

In the process used by Wheeling a film of liquid zinc ammonium chloride flux is applied in an aqueous bath which is held at approximately 180° F. This flux is so formulated that it can be dried and preheated to a temperature approximating 500° F., without breakdown or deterioration. The fact that this flux can be preheated to a high temperature is the key to the success of the process.

The reaction of the flux with the coating metal, and particularly with the aluminum in the coating metal, takes place at approximately 360° F. and, so long as the prefluxed article can be introduced into the coating metal at or above that temperature, the reaction takes place immediately at the point of entrance into the coating metal, the reaction products are stripped off at the surface of the metal, and there is no possibility that flux will carry through on the finished article.

Figure 7. Close-up view of the induction heated premelt pot in which the zinc metal for the line is melted and then run into the main pot through an electrically heated runway. Also shown is the conveyor which automatically feeds slab metal to the premelt pot. (All additions of aluminum for the process are added directly into the inductor throats of the main pot, and are not added in the premelt pot.)



In the case of continuous coating of strip, the fluxing operation is most important in attaining the ultimate goal in tightness of coating, although it is obvious that gaseous treatments or atmosphere treatments might also be used instead of the flux in order to take advantage of the controlled zinc-aluminum bath. The company has devised very ingenious means of applying a uniform flux layer in the continuous coating of strip, where gauges, sizes, and speeds vary over wide ranges.

Applying, levelling, and controlling film thickness of flux is done automatically, regardless of other varying conditions. The process also provides for drying the flux layer and preheating it, automatically, to a temperature at or above 360° F., and then introducing it continuously into the coating bath.

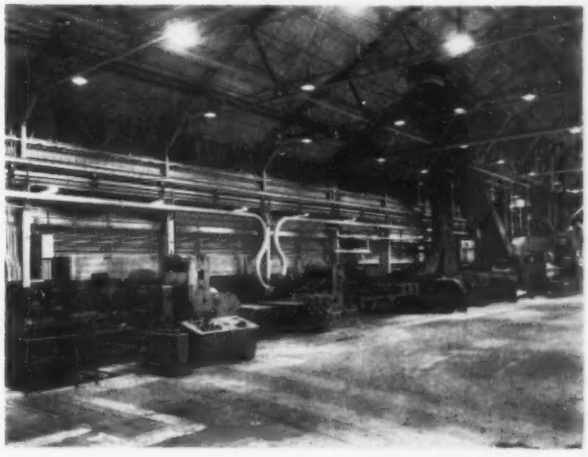


Figure 8. View of central portion of line (galvanizing pot at extreme right of picture) showing the cooling ducts and, immediately following the last cooling duct, a series of tanks and driers which are provided for continuously treating the strip to prevent discoloration of the finished product.

The fluxing technique is very easily controlled and gives no trouble in the process. The liquid flux solution is continuously filtered to remove foreign matter. In such a fluxing operation, there is a complete tank turnover in a very few days, and the iron content of the flux, under these conditions, is always held low enough that no treatment for removal of the iron is needed. And, incidentally, the method of fluxing when bonding one metal to another is still the most positive way of accomplishing the job, and the new process has definitely taken advantage of it.

Wheeling's method of production is generally considered an annealing-out-of-line type, as distinguished from other continuous coating processes. The material for the line is prepared at the mill by annealing the

(*Continued on page 73*)

Electroplating on Porous Metal

By J. B. Mohler, *Metal Finishing Consultant, New Castle, Pa.*

Introduction

THE process of electroplating is limited by the quality of the metal on which the deposit is applied. The appearance of a part can be improved by electroplating, but the use of an electrodeposit does not guarantee that the resulting appearance will be good. If the basic metal is oxidized, corroded, or rough the resulting deposit will reflect this condition. Inorganic oxides or surface films can be removed by cleaning, pickling and etching. Chemical or electrochemical means can be used to remove or clean surface films from the metal, but this will often leave an etched or rough surface in the areas where such films were removed. Although some electroplating processes have what is known as a "self-leveling" effect this will only correct very small surface imperfections. Of course, the surface can be machined, ground, polished, or buffed prior to plating and the desired finish can be produced. If the cost of such mechanical finishing is warranted then there is no problem. If the preparatory finishing cost is prohibitive then it is necessary to improve the processing method of producing the rough part. If the metal is porous then the problem is no longer a surface problem.

Porosity in metal is really quite common. The presence or absence of porosity is only a matter of definition. A metal part is declared to be sound if it passes a test for soundness. Such a test may consist of fracture, tensile strength, x-ray or blacklight. If the part passes the test it means that no porosity was detected or, only an acceptable amount of porosity was detected by the test used. Such tests are practical and are established on a basis such that, if the part passes the test, there will be no trouble in subsequent use or processing. A more sensitive test, such as very careful metallographic examination, could reveal microporosity, but the results might have no practical meaning.

In some cases, such as aircraft parts, standards for porosity have been set that would allow only a few pin point pores on a surface of 5 to 30 square inches, as detected by blacklight examination. Such standards have been applied to heavy silver electrodeposits on a steel backing. In such a process a nodular deposit may develop as shown in Figure No. 1. Where the nodules

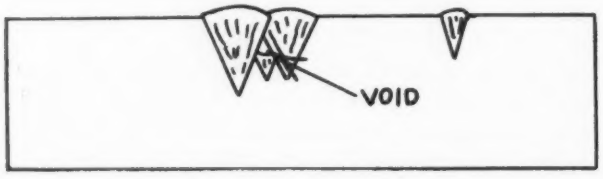


Figure 1. Void in a heavy silver electrodeposit at the juncture of nodular growth.

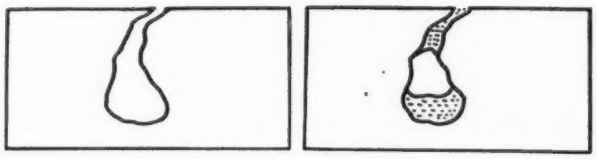


Figure 2. Void with a narrow neck at left and an air bubble trapped after immersion at right.

grow together a pore will be produced in the deposit. This condition has been overcome by the use of addition agents in the silver bath to produce a smooth semibright deposit. However, even with the best process, a few pores are unavoidable. Where a casting process is compared to this electroplating process it is easy to visualize the difficulty of producing a pore free casting. When metal freezes rapidly, the structure interlaces and then shrinks so that a few pores are bound to result.

Porosity is a part of the metal producing business and at times a fairly high degree of porosity may be acceptable. If such porosity is controlled, as by rimming of steel ingots, it is not objectionable. Also, porosity may be scattered throughout a casting and not be objectionable where no great mechanical demand is made on the part in service.

The Plating Problem

Electroplating of porous metals is not a frequent plating problem. Small amounts of porosity will not cause trouble and parts with excessive porosity are scrapped. However, porous parts that are acceptable are occasionally sent to the plating department and they cause real trouble. If the pores are of such a size that they will fill or partially fill with solution that will later seep out then process and appearance troubles may result.

An especially troublesome condition is shown in Figure No. 2. A pore is shown on the left with a small surface opening. Such a condition is produced by mechanical working of the surface, which tends to close the pore but does not close it completely. Solution seeps into the pore and displaces part of the air, but not all of it. Any increase or decrease in temperature will now cause the pore to act as a thermal pump. Solution will be released or another solution will be taken in at a subsequent processing step, depending on whether the bath is hotter or colder than the part. Irregularly shaped pores resulting from shrink porosity can cause this same sort of trouble. Spherical pores due to gas porosity are not likely to be troublesome. It is the deep pore or the inter-connected pores that will trap solution and then release it slowly. If solution is

trapped and then later released it can cause a number of troubles.

Process Troubles

A typical plating process is as follows:

1. Electroclean
2. Rinse
3. Pickle
4. Rinse
5. Electroplate
6. Hot Rinse
7. Dry

The electrocleaner generally consists of a hot alkaline solution. Under these conditions the air will be expanded in the pores and some solution will be taken in. When the work is carried to the cold rinse the cleaning solution will be drawn into the pores. The acid is usually warm and some of the cleaner will react with the acid within the pores or near the surface. This may not cause trouble but trouble may result at the plating step due to similar action. Whether the pores contain acid or alkali, they may cause precipitation of metal compounds on the surface in the plating step. Or, they may merely change the plating conditions in small local areas so that the normally clean, etched and active surface is destroyed. Porosity has been known to destroy the adhesion of nickel deposits over large areas.

Appearance Troubles

Porosity troubles result in spotty plating more often than in loss of adhesion. Such spotty plating generally shows up as the parts are being dried. A solution that contains residual salts seeps out of the pores and spreads over the surface as the surface is drying, to cause a stain. At times the spots will not develop for several days or they will become more pronounced with time. They may even develop on the customer's shelf.

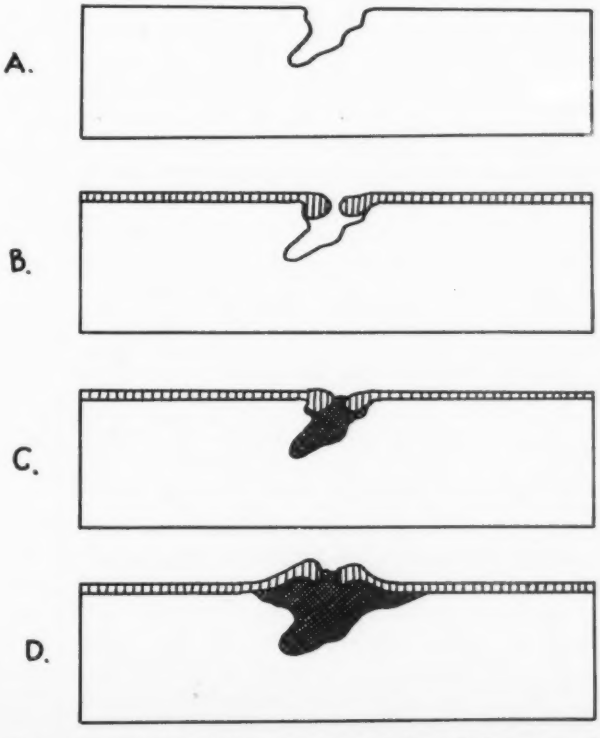


Figure 3. A. Before plating. B. After plating. C. Formation of corrosion products. D. Corrosion products lifting plating.

TABLE I

Causes for Spotty Plating Due to Plating Bath Troubles

Bath	*Appearance*	*Cause*
Cadmium	Occasional pits	Low caustic
Cadmium	Pits	Chromium in bath
Rochelle Copper	Cracks	Lead in bath
Nickel	Pits and cracks	High addition agent
Nickel	Pits or orange peel	Air or oil in bath
Zinc	Pits	Low caustic
Zinc	Pits	High cyanide
General	Blisters	Poor adhesion

Porosity can also be a source of corrosion troubles that develop on the shelf or in service. The pore itself may be free of solution, but the deposit may not bridge the pore and thus leave a point of attack for corrosion of the basic metal. Such a method of failure has been observed and reproduced in a modified salt spray test by C. F. Nixon.[1] If the plated casting is intended for protection from corrosion then, of course, every opening in the casting will be a source for failure.

Corrective Steps

Spotty plating is not always due to porosity of the basic metal. A spotty appearance may be due to pitted or blistered plating. The cause of the spotty plating should be determined as a first step. Some typical plating bath troubles are listed in Table I. If the trouble is in the plating bath then it will be apparent as the work is lifted from the bath. If the spots develop after leaving the rinse and, if they become more pronounced with time, they are almost surely due to porosity.

Blistered plating can be due to process troubles in the plating cycle and it can be due to porosity. In either case, it may show up as the part is leaving the bath and it may develop with time. If the blistering is due to troubles that result in poor adhesion it should be possible to get a knife under the deposit and peel it back. If the entire plated area is bad, it is probably due to some cause other than porosity. It can be due to porosity in such a case but, if it is, the porosity should be readily apparent by visual examination. When the plate is bonded around the blistered area then there may be a pore under each individual blister. The blister can be peeled away with a knife and the underlying area examined under the low power microscope. A pit near the center of the blistered area reveals the trouble.

The most obvious solution to the problem of porosity is to eliminate the porosity at the source. This of course should be done but, unfortunately, it takes time. Meanwhile a lot of parts may be at the plating step which is usually the final operation. Also the parts may be perfectly satisfactory with the exception of appearance. There are a number of things that can be done if the porosity is not excessive.

SURFACE CLEANING:

If the pores are relatively shallow, the spotty condition is one that will not reoccur if it is removed. The spots are then similar to water marks caused by drying

of water on a clean surface. If the parts can be wiped dry, such as by tumbling in sawdust, it may take care of the trouble. Also the parts can be buffed or polished. They can also be wiped with a polishing cloth or with a cloth containing oleic acid. If any of these steps result in a loss of appearance it may be desired to use further steps to restore the desired appearance. If such further steps involve a solution it is very likely that the spots will reappear.

PLATING TEMPERATURES:

It is sometimes possible to avoid spots due to porosity by avoiding extremes of temperature in the plating line. If a process can be developed using all cold baths it will minimize this problem. It is sometimes possible to clean with a cold electrolytic cleaner, then use a cold electrolytic etch and a cold plating bath. All the baths and the rinse tanks will then be near room temperature. This is not a likely solution to the problem but cold plating lines have been used.

USE OF OIL:

If the pores can be filled with oil it may solve the problem. This has been done in several different ways. In one case trouble had been experienced with loss of bond of nickel plating to bronze parts, and oil was used to fill the pores prior to plating. The parts were heated in a vapor degreaser and, while hot, they were immersed in cold oil. After cooling, they were removed, allowed to drain, and surface cleaned by rinsing in cold solvent. They were then plated in the conventional way and the bond was good.

In another case spots developed on bronze castings after plating in an alkaline tin bath. The problem was very simply solved by adding ½ pint per gallon of soluble oil to the hot rinse tank. This left a very thin film of soluble oil on the surface and there was some loss of appearance, but there was no more trouble with spots. On the other hand it was found that the parts that were processed with soluble oil in the hot rinse were not subject to stains from finger prints whereas, without the use of soluble oil, finger prints were a problem.

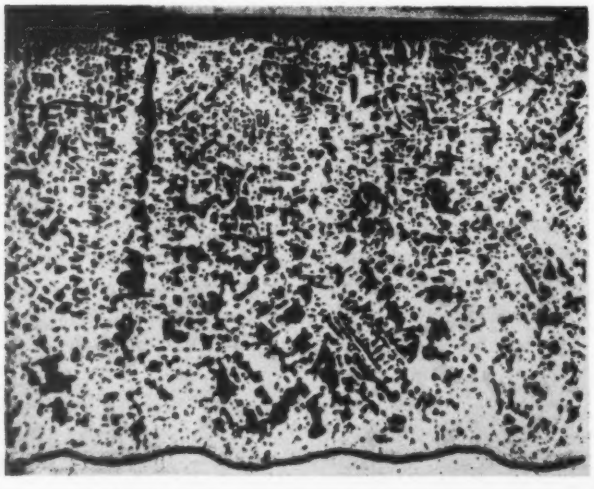


Figure 4. A cast 70-30 copper-lead alloy showing dendritic structure obtained due to rapid freezing. Voids can form due to freezing of molten metal in this same irregular manner. 100 X.

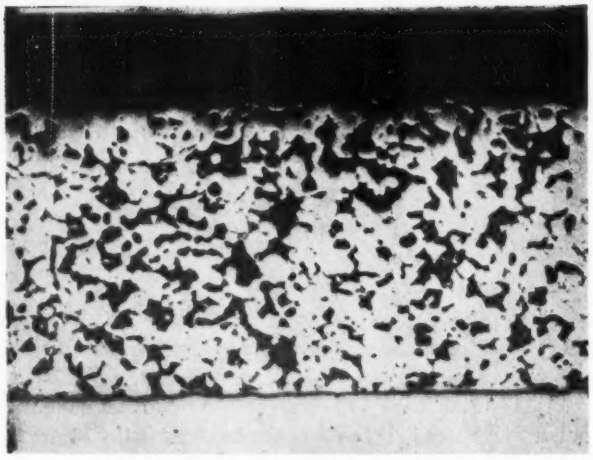


Figure 5. Sintered, rolled, and resintered, dense, 70-30 copper-lead alloy showing sponge structure of copper matrix. This is similar to structure obtained in a high porosity sintered part where the dark areas would represent voids. It can be seen how a solution would readily fill such a structure and later seep out during a plating process. 100 X.

Plating of Powder Metal Parts

There is considerable interest in the plating of powder metal parts. The experience with porosity in cast parts gives an indication of method of approach, but it has also shown that high porosity presents a very difficult plating problem.

Powdered metal parts are only difficult to plate because they are porous. If the metal is dense there is no trouble. Where dense metal is used, such as for bronze lined steel backed bearings, there is no trouble with plating. However, this means that the part made by methods of powder metallurgy would have to be made with essentially a pore free surface. This has been done on strip stock bonded to steel but it has not been done by the pressing and sintering method for making shapes. Also it is not likely that a continuous plated coating will be obtained on powdered metal parts unless the pores are closed by mechanical means or closed by impregnating with a current conducting material.

The experience with porous castings does not offer a solution for plating on powdered metal but it does help to define the problem. Shaw, Knopp and Clark[2] have pointed out that porous metal parts are made with various degrees of porosity and that a plating technique would have to be worked out for each part.

Kuzmick[3] suggested using heat treating to remove the residual plating salts. The "Etolizing" process was developed on this basis. The parts were either plated as green compacts and then sintered, presintered then plated and resintered, or fully sintered then plated and heat treated. After plating, the parts were washed and acid dipped to neutralize alkaline salts.

Scott[4] described a method for successfully plating porous brass lock parts by the use of a definite cycle. Graham, Pinkerton, Anderson and Reinhard[5] reported some degree of success by the use of buffing and burnishing methods. Raymond, Foley and Chu reported successful plating of powder-metallurgy bronze parts of 90 percent density with a stannate tin bath by the use of an oil impregnation method.[6]

It would seem that the statement that specific methods will have to be worked out for case is correct.

If the part is dense, normal plating practice can be used. If it is low in porosity, methods can be used that have been used for porous cast parts. If porosity is high, the method will be determined by cost and by the application. Heat treating methods may be satisfactory for sintered brushings where the plated surface is used for engineering purposes and the part is hidden within a machine. Buffing and burnishing methods may be satisfactory where appearance is a factor and size is not important.

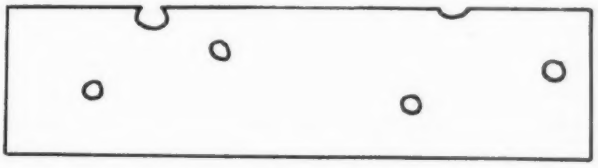


Figure 6. Spherical voids due to gas porosity do not readily trap solution.

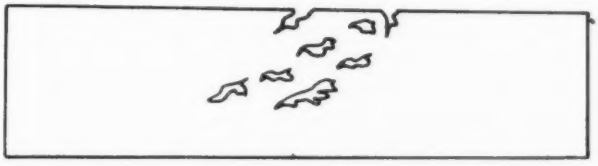


Figure 7. Irregular voids due to shrink porosity are difficult to wash.

Figure 8. Deep voids formed by a lap in the metal.

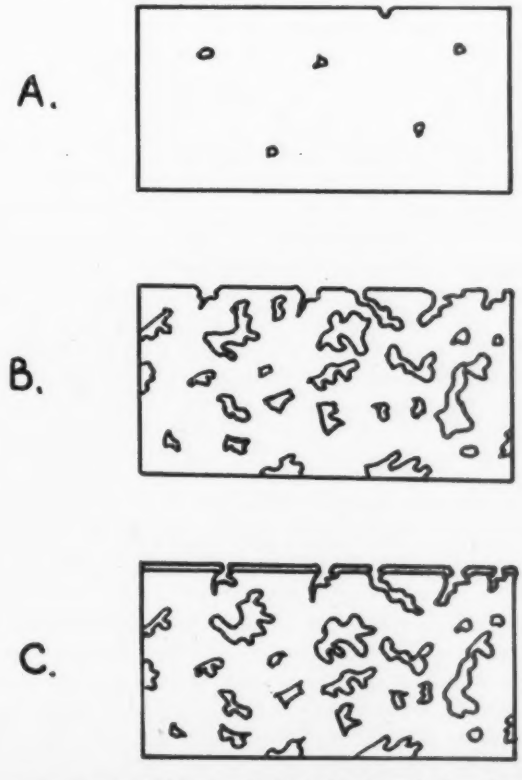


Figure 9. Powdered Metal. A. High Density. B. Low Density. C. Plated, showing incomplete coverage which results in poor appearance and lack of protection by the coating.

TABLE II

Possible Methods for Plating Powder Metal Parts

Porosity	*Material*	*Plating Method*
Nil	Sintered bronze on steel	Normal
Nil	Sintered carbides	Normal
Nil	Sintered under pressure	Normal
Nil	Sintered then coined	Normal
Low	High compacting pressures	Burnish and plate
High	Porous bushings	Plate and heat

Table II summarizes methods and conditions where some success has been indicated. From the work that has been reported to date there is not sufficient evidence to indicate that a general method will apply to all cases.

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1. C. F. Nixon, The Monthly Review, **32**, 1105 (1945).
2. J. D. Shaw, W. V. Knopp and C. L. Clark, Metal Finishing, **49**, 56 (Nov. 1951).
3. J. F. Kuzmick, Materials and Methods, **31**, 55 (June 1950).
4. P. K. Scott, Iron Age, 87 (April 20, 1950).
5. A. K. Graham, H. L. Pinkerton, E. A. Anderson and C. E. Reinhard, Plating, **36**, 702 (1949).
6. E. V. Raymond, R. T. Foley and W. L. Chu, Plating, **42**, 150 (1955).

CONTINUOUS HOT GALVANIZING

(*Continued from page 69*)

coils in batch form in deoxidizing atmospheres, and by temper passing the material if desired.

In the firm's first continuous line, which has now been in operation for some eighteen months, the largest induction heated pot built to that time was used, employing a total of approximately 1100 kw. maximum power to the inductors. This first line processes strip material from 18 to 30 gauge, inclusive, in widths from 24 to 36 inches, inclusive, and at processing speeds from 50 to 300 fpm. Coils up to 36,000 pounds in weight, or up to 72 inches in outside diameter, are entered into the line, and the finished material is either rewound into coils, or furnished in any cut length required. Maximum production from this first line was rated at approximately 20 tons of galvanized material per hour.

This second line incorporates many new developments and is designed for material from 10 to 24 gauge, primarily, but 30 gauge may also be coated on the line. Widths are from 24 to 48 inches, inclusive, with processing speeds from 50 to 300 fpm. Black coils up to 40,000 pounds in weight, or up to 72 inches in outside diameter, are entered on the line, which has two decoilers, with auxiliary equipment.

This second line has an induction capacity of approximately 2300 kw., by far the largest such furnace ever built, there being six inductors on the coating pot alone. The pot holds approximately 175 tons of metal. This line will produce from 45 to 50 tons per hour of coated material in the heavier and medium gauges. For average gauges, which will be processed through the line, it is expected that the monthly production will be in excess of 20,000 tons of galvanized materials.

Surface Treatment and Finishing of Light Metals

Part VII. — Industrial Anodizing of Aluminum and Its Alloys

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M. and R. Pinner, B.Sc.

This is the third and final installment of Part VII of the series by Dr. Wernick and Mr. Pinner.

Ed.

Oxalic Acid Processes

These were first developed in Japan, then introduced to Germany where they were in extensive use though, in recent years, they have given ground to the sulphuric acid process. Their main advantages are for specific application such as the production of very hard or thick coatings in which the materials used are similar to those described for sulphuric acid, and for the colors obtainable which, depending on alloy composition, may range from silver to bronze, as for anodizing of wire, strip, etc.

The oxalic acid processes are more expensive than the sulphuric acid processes, both in chemicals and current, but thicker coatings of up to 60μ may be obtained without the use of special techniques, increase of film thickness being almost linear during the first hours of treatment.

The four standard German processes using solutions containing 3 to 5% oxalic acid are operated as follows:

Eloxal GX — This is the basic d.c. process, and current densities of 10 to 20 amp./ft.^{2} are applied at 40 to 60 volts. The bath is kept at 18 to 20°C. and the treatment time is 40 to 60 minutes. The coatings obtained are yellow in color on aluminum and alloys not containing heavy metals, and have good wear resistance.

Eloxal GXh — This is a modification of the Eloxal Gx process, in which the temperature is raised to 35°C. with a resulting drop in voltage to 30 to 35 volts. The treatment time is shorter, 20 to 30 minutes as, at the increased temperature, the limiting thickness is reached earlier. Coatings produced by the GXh process are almost colorless, and this and their increased porosity makes them more suitable for dyeing, and for photographic processes. They are, however, somewhat softer and thinner.

Eloxal WX — This is the a.c. process, operated at 20 to 30 amp./ft.^{2} at 20 to 60 volts. The bath temperature is 25 to 35°C. and the time of treatment is 40 to 60 minutes. The coatings are much softer and find application in anodizing wire and elastic strip. The work is both anode and cathode alternately, and the voltage must be increased gradually from 20 to about 60 volts. The coatings are yellow on aluminum and somewhat darker on heavy metal containing alloys.

Eloxal WGX — This is a combination of the GX and WX process, and the proportions of a.c. to d.c. may be varied according to the hardness and color required. The normal range is 20 to 30 amp./ft.^{2} d.c. at 30 to 60 volts, and 10 to 20 amp./ft.^{2} a.c. at 40 to 60 volts. Temperatures of 20 to 30°C. may be used, and the operating time is 15 to 20 minutes. An aluminum-manganese alloys this process gives coatings of greater wear resistance than any other.

Neither of the processes using a.c. are in wide use, chiefly due to their high cost.

As described recently by Tajima,[60] oxalic acid anodizing is still largely used in Japan. The normal method is to employ a 3% solution at 10-20 amp./ft.^{2} and 75-95°F. for 30-80 mins., using 15-30 volt d.c. and 60-100 volt a.c. with lead or graphite cathodes for the d.c. Lead or asphalt lined tanks are usually employed with water cooling. Common practice is to follow anodizing by steam sealing under 70 p.s.i. pressure for 30-60 mins. and, subsequently, the coating may be lightly buffed. The anodic film is a light gold color.

In Britain and America oxalic acid solutions of slightly higher acid content, 5 to 10%, are in use, and semi-transparent coatings are obtained at 10 to 15 amp./ft.^{2} d.c. at 50 to 65 volts. The treatment times at 30°C. is 10 to 30 minutes.

As in the sulphuric acid processes, tanks are lined with lead or rubber. Separate cathodes are used in the d.c. processes, and these may be of lead, stainless steel, iron, or sometimes graphite. Agitation, cooling, and filtration are as for sulphuric acid. No exhausts are normally required. As the electrolyte is not corrosive, the oxalic acid process may be used for parts with crevices, joints, etc., in which case, after anodizing and rinsing, the work may be dipped in 1% ammonia or ammonium bicarbonate.

Effect of Operating Conditions:

In general, most of what has been said about the influence of operating conditions an anodic oxidation in sulphuric acid will apply also to oxalic acid anodizing.

As in other processes, the anode efficiency and the maximum film thickness vary with the temperature, both in the d.c. and a.c. processes. In a 5% oxalic acid solution, for instance, 1.2 amp./dm.^{2} d.c. produces no coating at all at above 50°C., while a.c. at 4 amp./dm.^{2} will form a coating up to 60°C.[61]

The effect of temperature and pH of oxalic acid

electrolyte on the film thickness is shown in Fig. 12. These results which were obtained by Hubbner[62] show that, as the temperature increases, the coating thickness decreases. With increase in pH at high temperatures, the coating thickness curve goes through a maximum and the optimum is shown to lie between pH 1.5-2.5. The best anodizing conditions are, however, at lower temperatures, between 25-40°C. where the optimum pH value is approx. 0.5-1.0, corresponding to approx. 3-8% oxalic acid.

The relationship between oxalic acid concentrations and voltage on the coating thickness is seen in Figs. 13 and 14 which show results obtained by Jenny[11] in the d.c. and a.c. processes. It is seen that, in general, d.c. anodizing gives much higher coating thicknesses, due to the greater heat developed in the coating, partly due to the rectification effect, partly due to oxygen evolution.

Addition of oxalic acid may be made on the basis of current consumption, approximately 0.13 to 0.14 g. oxalic acid is used per amp. hour while 0.08 to 0.09 g. aluminum per amp. hour goes into solution.[6] The aluminum going into solution forms aluminum oxalate and 5 parts by weight oxalic acid are added for each part by weight dissolved aluminum. As the aluminum content rises, the current density is decreased and the solution is discarded when 3% aluminum is present.

The oxalic acid solution is very sensitive to the presence of chloride, and must not contain more than 0.04 g./l. when anodizing aluminum, and not more than 0.02 g./l. in treating duralumin type alloys.

Other Processes

BARRIER TYPE COATINGS:

Boric acid solutions are employed in the production of extremely thin dielectric films for use in electrolytic condensers. Solutions contain approximately 8 to 10% H_3BO_3, to which 0.2 to 0.25% borax is sometimes added. High temperatures, 70 to 95°C. are used at 230 to 250 volts.

Recently, anodic coatings of the barrier type have been used to protect aluminum coatings produced in the production of mirrors by high vacuum evaporation. Holland and Sutherland[63] used a solution containing 3% ammonium tartrate at pH 5.5 for this purpose with aluminum cathodes. Only very thin films can be used here as the aluminum deposits are themselves only between 1-10 microinches thick. In the solution given, the film thickness is increased by 13Å per volt applied and, in measuring the reflectivity at various film thicknesses at a number of wavelengths, the most achromatic mirror over the widest range of incident angles was shown to be obtained with anodic oxide film 1,400Å thick, which also gave good abrasion resistance.

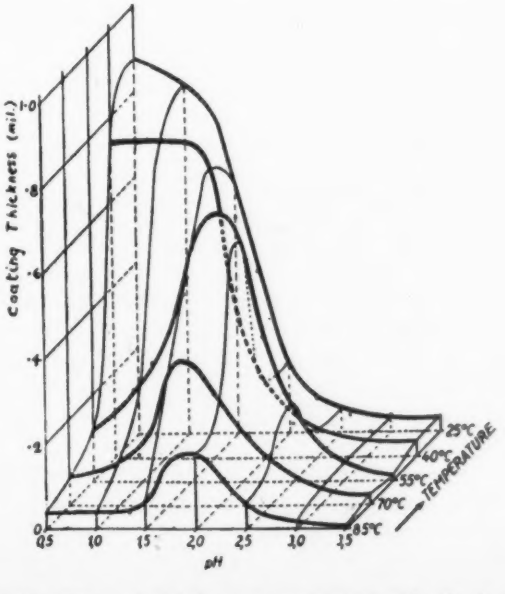

Figure 12. Effect of variations of temperature and pH of oxalic electrolytes on film thickness produced on 99.5% aluminum.

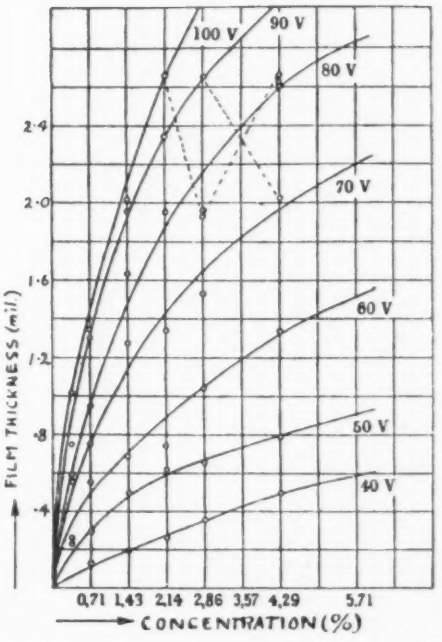

Figure 13. Growth of film at constant voltages D.C. and different concentrations of oxalic acid.

SULPHAMIC ACID:

This was developed by R. Piontelli,[64] who has applied sulphamic acid to many electroplating processes. This author employed solutions containing 20% NH_2SO_2OH at 30 to 40°C. Current densities of 1 amp./dm.^{2} are used, while the voltage is gradually increased during the operating time of 45 minutes. The coatings are denser and less porous than those produced in sulphuric acid, and do not require sealing. In the U.S.A. a sulphamic acid process was developed,[9] using a 5 to 10% solution at 6 to 25 amp./ft.^{2}. The bath temperature is kept at 40°C.

Tanks are of stainless steel or steel lined with acid resisting materials. Separate lead cathodes are used. The voltage is raised from 5 to 45 within the first 3 to 5 minutes, and maintained for 15 to 40 minutes. In this process, the coating is porous and is sealed in the usual way, as it may be dyed.

At the present time, however, the cost of sulphamic acid is relatively high, and the process is not economically competitive with sulphuric acid.

PHOSPHORIC ACID:

One of the methods of electroplating of aluminum

depends upon deposition on an anodized coating. Two of the processes utilizing this technique are the German Elytal and the American Krome-Alume process. 'Modified' oxalic or chromic acid coatings are used for this purpose. German workers[65] have, however, found that coatings produced in phosphoric acid are more satisfactory and the process has been developed on an industrial scale both in America and in Britain.

PEINTAL PROCESSES:

These are Swiss processes[26] employing sulphuric or oxalic acid electrolytes, with sulphoricinic acid or derivatives of condensation products of sulphonated naphthalenes.

OPAQUE COATINGS:

Most important of these is the Ematal process developed by Schenk,[67] in use mainly in Switzerland, which employs an oxalic acid solution containing salts of thallium, zirconium or titanium. The latter hydrolyze in the coating, the hydroxides producing a milky, opaque, non-metallic appearance, which resembles porcelain or enamel. The bath is operated at 2 to 3 amp./dm.^{2} d.c., and 120 volts. The operating time is 20 to 40 minutes, and the solution is kept at 50 to 70°C. The pH of the solution is critical and must be kept at 1.6 to 3.0.

The corrosion resistance is claimed to be as good as that of sulphuric acid coatings, and the coatings can be dyed satisfactorily, especially to pastel shades. Most wrought alloys containing less than 2% copper, and alloys containing less than 1% Mn, 1% Fe, 1% Ni, 2% Cu, and 8% Zn or Mg, are suitable for treatment by the process.

The following solutions may also be worth mentioning for obtaining opaque coatings for mixed electrolytes:

	I	*II*
Chromic acid, %	10	5
Oxalic acid, %	2	0.5
Boric acid, %	—	0.2-0.5
Phosphoric acid, %	5	—
Water	balance	balance
Current density, amp./ft.^{2}	5- 8	8-10
Voltage	20-30	25-40
Temperature, °C.	30-50	30-50

The opaque coatings obtained are built up to 0.8 mil in 60 min. and may be dyed. Superimposed a.c. may also be used to obtain a white or grey-yellow film.

The addition of over 3% zirconium to sulphuric or oxalic acid electrolytes has been described by Freud and Frasch.[68] These authors add zirconium in the form of a sulphate complex $(ZrO(SO4)_6)H_2O$ to the sulphuric acid solution, which is operated at 35° C., 18 volt, 80 amp./ft.^{2} for 30 min. with lead cathodes. Anodizing is followed by sealing for 10 min. in boiling water.

Chemical Control of Anodizing Solutions

SULPHURIC ACID PROCESS:

For routine control it is usual to determine the "free" sulphuric acid, i.e., that not neutralized by dissolved aluminum in the form of $Al_2(SO_4)_3$, the aluminum content, and the chloride content.

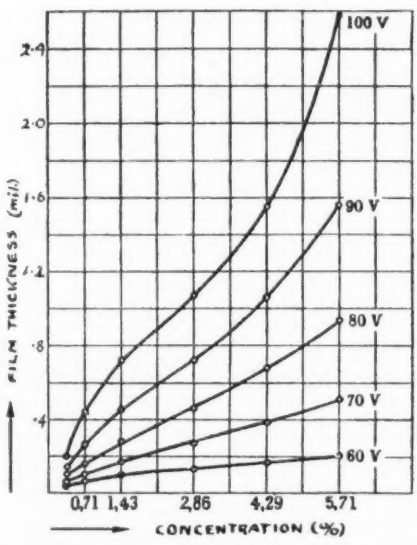

Figure 14. Growth of film in relation to concentration of oxalic acid during anodizing with constant voltage alternating current.

For this purpose 50 ml. of solution are diluted to 250 ml. and this is used as stock solution.

Free Sulphuric Acid[31]

Ten ml. of the stock solution are pipetted into a conical flask and diluted to approximately 100 ml.: 1 gm. potassium fluoride and 1 ml. of a 0.1% alcoholic solution of thymol blue are added and the acid titrated against N sodium hydroxide until a permanent blue end point.

$$1 \text{ ml. N NaOH} = 1.33\% \ H_2SO_4 \ (V/V)$$

Aluminum[31]

1) Pipette 25 ml. of the stock solution into a 250 ml. flask containing excess N sodium hydroxide. Add 1 ml. thymol blue solution and titrate against N nitric acid until the color changes from blue to grey. This method determines the "total" sulphuric acid and the aluminum is obtained by difference.

$$1.8 \times (\text{ml. N NaOH} - \text{ml. N } HNO_3) - 4.5 \times \text{ml. N NaOH in "free" sulphuric acid titration} = \text{Al in g./l.}$$

(2) Direct estimation.[6] 50 ml. anodizing solution are diluted to 500 ml.; heat to 70° C. and slowly pass H_2S for 30 minutes. Filter through a glass filter, wash with dilute H_2S solution. Boil off H_2S from filtrate, and add 2 ml. 3% hydrogen peroxide. Cool the solution, transfer to a 500 ml. measuring flask and make up to the mark with distilled water. Pipette 25 ml. of this solution into an 800 ml. beaker, add a few drops of methyl orange and add 1:1 ammonia until the color changes. Add 4 ml. conc. hydrochloride acid, dilute to 400 ml. and boil. To this solution add 20 ml. of 25% sodium-thiosulphate solution, 10 ml. glacial acetic acid and 10 ml. of a 10% of ammonium-phosphate solution. Boil for 15 minutes. Allow the precipitate to settle, and filter through a fast filter paper. Wash well with hot water, transfer to a crucible and dry at 105 to 110° C. Ignite at 1,200 to 1,300° C. to

constant weight. The precipitate is $AlPO_4$ (1 g. $AlPO_4$ = 0.22107 g. Al.).

Chloride[31]

To 100 ml. of the stock solution add 10 ml. nitric acid (d. 1.42) and 50 ml. 1% silver nitrate solution. Allow the precipitate to settle, filter through a weighed Gooch crucible, wash with 2% nitric acid, dry and weigh as AgCl. Calculate to NaCl.

$$AgCl \times 0.65387 = NaCl$$

CHROMIC ACID PROCESS[31]

Five ml. of the anodizing solution are diluted to 250 ml. with distilled water and 30 ml. dilute sulphuric acid (d. 1.2) are added. The solution is boiled and 1% potassium permanganate solution is added until the pink color or brown precipitate is permanent. Boil for 20 minutes. Allow to cool, and add 1 mg. manganous sulphate. Boil for 5 minutes, cool, filter, wash the precipitate, add 30 ml. dilute sulphuric acid to the filtrate and titrate against $\frac{N}{10}$ ferrous ammonium sulphate and back titrate with $\frac{N}{10}$ potassium permanganate.

$$\text{F.A.S. (ml.)} + 0.0666 \cong CrO_3\text{(g.)}$$
per 100 ml. solution

Free chromic acid[31]

(1) This method is for used solutions only. 10 ml. of the anodizing solution are diluted to 100 ml. with distilled water and the solution titrated to permanent turbidity against $\frac{N}{2}$ sodium carbonate.

$$\frac{N}{2} Na_2CO_3 \text{ (ml.)} \times 0.5 \cong \text{free } CrO_3 \text{ (\%)}$$

In this method greater accuracy is obtained by using a Nessler tube with a standard.

(2) On new solutions,[23] 5 ml. of anodizing solution are diluted to 250 ml. Add 3 ml. dilute sulphuric acid (d. 1.2). The solution is titrated against $\frac{N}{10}$ potassium permanganate, as in the total acid determination.

(3) The free chromic acid may also be obtained by pH measurement with the use of a glass electrode.[14] The free CrO_3 content can then be calculated, or read off from a graph.

From the values for 'total' and 'free' acid the aluminum content may be calculated.

Chloride[31]

Dilute 50 ml. anodizing solution to 300 ml. Add 20 ml. concentrated nitric acid and boil. Add 5 ml. 3% silver nitrate solution and proceed as in the case of sulphuric acid process above.

OXALIC ACID PROCESS[6]

Total Oxalic Acid

Twenty-five ml. anodizing solution are diluted to 250 ml. in a measuring flask. To 25 ml. of this solution, add 25 ml. 2N sulphuric acid, warm to 60 to 70° C. and titrate against $\frac{N}{10}$ potassium permanganate to a permanent violet.

$$1 \text{ ml.} \frac{N}{10} KMnO_4 \cong 0.0063 \text{ gm. } (COOH)_2 \cdot 2H_2O$$

Free Oxalic Acid

Dilute 250 ml. anodizing solution to 100 ml. add 2 to 3 drops of a 1% solution of phenolphthalein in alcohol and titrate against N sodium hydroxide until the permanent pink end point.

$$1 \text{ ml. N NaOH} \cong 0.063 \text{ g. } (COOH)_2 \cdot 2H_2O$$

Aluminum and Other Metal Ions

Calculate from combined acid value, i.e. total acid — free acid × 0.2 = Al (%)

An alternative method of controlling the solution is to base additions on values calculated from ampere-hours passed.

Oxalic acid lost per amp.-hour approximately 0.132 g.

Aluminum dissolved per amp.-hour approximately 0.084 g.

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Science for Electroplaters

8. Solutions

By L. Serota

SINCE electroplating operations and control are concerned primarily with solutions, a basic knowledge of the terms relating to this phase of the procedure is essential for effective interpretation of daily plating problems, analytical reports and relevent technical literature.

A solution is defined as a homogeneous (uniform) mixture wherein the proportion of the materials may vary within certain limits. The limits are defined by the specific materials used. The variation in proportion may be demonstrated by indicating the two formulas with different concentrations in use for the chromium plating baths, with sulfuric acid as the catalyst. One bath operates with 33 oz./gal. of chromic acid (CrO_3), whereas the concentration of CrO_3 for the second bath is 53 oz./gal. Limits of solution can be shown by lowering the temperature (freezing out method), thereby reducing the concentration of sodium carbonate in a sodium silver cyanide solution.

The term *solvent* usually refers to the constituent present in greater amount. The other constituent is called the dissolved substance or the *solute*. When a formula for a cleaning fluid or for an electroplating bath solution indicates the number of ounces per gallon of the alkali, salt, or acid to be added, the water required to make up the solution is considered the solvent and the ingredient added is the solute.

Solutions may be classified under the following divisions:

(a) gases dissolved in gases, in liquids or in solids
(b) liquids dissolved in liquids or in solids
(c) solids dissolved in liquids or in solids

Some examples of gas mixtures (solutions) are hydrogen mixing with the air above an anodizing tank; traces of hydrocyanic acid gas present over a freshly prepared cyanide tank mixing with the air. A solution of gas in liquid is best demonstrated by the carbon dioxide and oxygen of the air dissolving in the solution of a cyanide tank and reacting with the caustic soda and sodium cyanide. The solution of a gas in a solid occurs in a plating tank when hydrogen is discharged with the metal at the cathode. The hydrogen in this process may dissolve in the metal or form compounds with the deposited metal. During the pickling process or the cathodic cleaning of steel, some of the hydrogen that is liberated is dissolved in the metal causing hydrogen embrittlement. Hydrogen will dissolve in appreciable amounts in palladium.

The use of addition agents in electroplating solutions represents examples of solutions of liquids in liquids: diethylene triamine in the amine bright copper baths; molasses in the acid copper bath; cresol sulfonic acid in acid tin bath; propionic acid in electropolishing brass; butyl alcohol used with many metals; or glycolic acid used with sulfuric acid. In stripping baths, examples would be glacial acetic acid used with hydrogen peroxide in stripping lead from copper alloys and steel, and glycerine with sulfuric acid for stripping nickel from steel. An example of a solution of a liquid in a solid is the mercury amalgam with a basis metal, such as copper and brass in silver plating. This is achieved by immersion of the basis metal in a solution of a mercury salt. Mercury is displaced and deposits on the basis metal. Metallic mercury is a liquid and amalgamates with the copper or brass. A preparation used for this purpose is called a "blue-dip."

Examples of solids in liquids would be the addition of any of the salts to cleaning baths or electroplating baths. Some alloys are solid solutions (at ordinary temperatures) with one metal dissolved in another metal. Yellow brass containing from 20% to 38% zinc is an example of a solid solution.

The amount of a salt that will dissolve in a given quantity of water will vary with the specific compound and the temperature of the solution. Silver cyanide, which is practically insoluble in water, is very soluble in a sodium cyanide solution, forming the silver cyanide complex ion, $Ag(CN)_2^-$. When the temperature is lowered in a sodium silver cyanide bath with a high concentration of sodium carbonate, some of the salt will settle out in the form of small crystals. These crystals may become attached to the cathode, resulting in poor silver deposits. If the sodium carbonate is present in the solution to the extent of 10 oz./gal. a burnt deposit may result. The potassium cyanide bath, therefore, is preferred because of the greater solubility of potassium carbonate, which has a tolerance of 15 oz./gal. compared to the recommended limit of 6 oz./gal. of sodium carbonate.

A situation encountered during the winter months relates to the same factor of difference in solubility with changes in temperature. Because many salts in a plating solution are less soluble at a lower temperature, a long, cold, winter weekend will result in salts crystallizing (settling out). This will change the concentration of the salts in the bath, thereby affecting adversely the conductivity and the current density required, when operation is resumed. This same question of crystallizing is strikingly emphasized by the high solubility of copper fluoborate and nickel sulfamate. These types of high concentration bath may be used without having salts crystallizing on tanks and equipment. The control of the amount of sulfuric acid in a plating tank by the addition of barium carbonate is another application of the property of solubility. This control depends upon the insolubility of barium sulfate that forms when the barium carbonate reacts with sulfuric acid. Barium sulfate remains as a sludge in the bottom of the tank.

The use of the fluosilicate, fluoborate, pyrophosphate and sulfamate baths has gained in application because of the solubility of the metal compounds. The copper fluoborate, $Cu(BF_4)_2$, bath, because of its greater solubility and higher concentration, permits operation at a higher current density and faster plating rates than that possible in the operation of the acid sulfate. Fluoborate baths for tin, $Sn(BF_4)_2$ (stannous), and cadmium, $Cd(BF_4)_2$, show the same advantages. Some analytical procedures (control) are based upon a knowledge of the difference in solubility of compounds.

Solubility Curve

Solubility of a salt (or acid or alkali) under varying conditions is a

governing factor in the operation and control of the plating processes. Tables containing such values are available in standard textbooks, guidebooks and handbooks. Reference to such sources of data is an important factor in plant and laboratory procedures. The solubility of the compound at various temperatures is usually expressed as grams of compound dissolved in one hundred grams of water. Another convenient method for recording such data is to express the amount (concentration) of the compound in solution in terms of its specific gravity (or Baumé). Baume readings are a routine part of most plating processes. The instrument used is called a *hydrometer*. The results may be recorded as per cent of weight for a specific temperature. The specific gravity of the solution or Baumé reading may also be represented in terms of ounces per gallon for the compound.

The practical phase of this method can be shown by its use in determining the amount of chromic acid (CrO_3) in a chromium tank solution. The reading on the Baumé hydrometer can be referred to a table, which will indicate the amount of chromic acid in oz./gal. This is a rapid method commonly used for checking tank concentrations. A table containing such data recording the densities of chromic acid from 1.50° Bé (2.1 oz./gal. CrO_3) to 36.00° Bé (64.8 oz./gal. CrO_3) is printed in the METAL FINISHING GUIDEBOOK. The temperature at which the reading is made must correspond to that indicated on the hydrometer. Inattention to this precaution is frequently the cause of errors in adjusting tank concentration. Another precaution concerns the presence of additional compounds in solution in a chromium bath in use for some time. A higher Baumé reading will be obtained, which will not be an accurate indication of the amount of chromic acid (CrO_3) actually present.

A graphical method of representing such data is a convenient and frequently used procedure. It is helpful because the amount of material dissolved at various temperatures, or the full range of Baumé readings and amount of CrO_3 for each value, may be observed at a glance. This is known as a solubility curve. Interpretations of the values indicated in such graphs serve as an important aid in technical evaluations. This method is used extensively in published reports.

The simplest way to learn how to read such graphs is to construct one. The chromic acid bath discussed can be used for this study. Baumé reading and chromic acid (CrO_3) in oz./gal. will be represented. Let the values representing the CrO_3 in oz./gal. be marked off on the horizontal line in Fig. 25. This is known as the x-axis; the term abcissa refers to values along this line. A line drawn vertically and perpendicular to the x-axis at point is called the y-axis; values along this axis are known as ordinates.

The values of 22 oz./gal. CrO_3 and 15° Baumé will be plotted. Point (a) on the x-axis represents 22 oz./gal. of chromic acid on the scale. A perpendicular broken line is drawn upward from this point. At the point (b) on the y scale, representing a reading of 15° Baumé, drawn a horizontal broken line. The point where the two broken lines cross will be point (c). Point (c) is thus defined by the two coordinates and represents the value of 15° Bé and 22 oz./gal. CrO_3. If a sufficient number of values are plotted, a series of points such as point (c) would be established. These points when connected would, in this example, result in a curved line from which any values may be obtained. Fig. 26 is a solubility curve representing the conversion of degrees Baumé to oz./gal. of chromic acid (CrO_3) plotted from data indicated on graph. Point (a) on the curve represents the values 15° Bé and 22 oz./gal. CrO_3. Point (b) corresponds to 25° Bé and 40 oz./gal. CrO_3. Suppose the hydrometer reading for a sample taken from a chromium bath is 21° Bé. To determine the amount of chromic acid in oz./gal. that the tank contains locate the value of 21° on the Baumé scale (y-axis) and extend a horizontal line from this point to the curve. Where this horizontal line crosses the curve, point (c) drop a vertical line to the x-axis. The value this line indicates on the x-axis scale will be the concentration in oz./gal. of the chromic acid. On this curve the

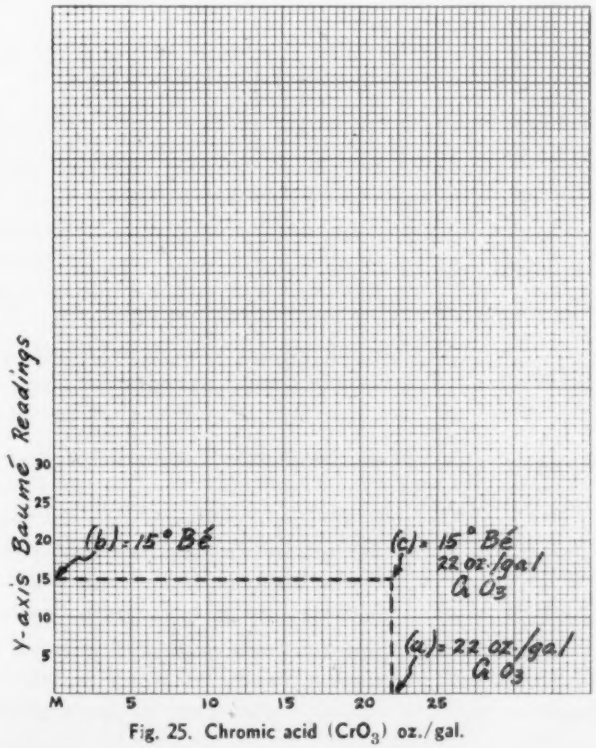

Fig. 25. Chromic acid (CrO_3) oz./gal.

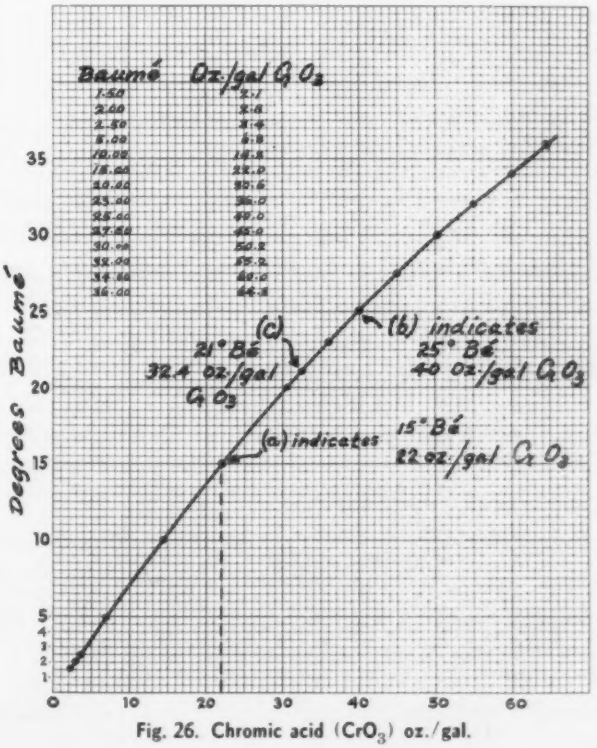

Fig. 26. Chromic acid (CrO_3) oz./gal.

value of chromic acid represented for 21° Bé is 32.4 oz./gal. CrO_3.

The extensive application of this graphical method to tank control is emphasized by graphs that appeared in the February 1948 issue of METAL FINISHING, for control by specific gravity of an acid copper bath, for a Watts type nickel bath that can be used for three different tank temperatures, and a graph for a silver cyanide bath. R. E. Harr refers to control of most of the alkaline cleaning solutions in the Process Control of Electroplating at the Western Electric plant, on the basis of specific gravity tests. It is a striking indication of the advantages gained in utilizing technical "know-how" to daily practices.

Specific Gravity

Specific gravity refers to the ratio between the weight of a volume of a substance (solid or liquid) and the weight of an equal volume of water at a stated temperature. A gas is usually compared with air. The term is used to express the relative weights of matter.

$$\text{specific gravity} = \frac{\text{weight of a substance}}{\text{weight of an equal volume of water}}$$

For example, a cubic inch of nickel weighs 0.322 lb., whereas a cubic inch of water weighs 0.0361 lb. (English system), hence

$$\text{specific gravity (nickel)} = \frac{0.322}{0.0361} = 8.9$$

In the metric system, ten cubic centimeters (10 cc.) of nickel weighs 89 grams whereas 10 cc. of water weigh 10 grams, hence

$$\text{specific gravity (nickel)} = \frac{89}{10} = 8.9$$

As another example, a cubic foot of sulfuric acid used for the pickling bath weighs 114.5 pounds and a cubic foot of water weighs 62.37 pounds (60° F.) (English system), hence

$$\text{specific gravity (sulfuric acid)} = \frac{114.5}{62.37} = 1.8354$$

In the metric system, one hundred cubic centimeters of the same acid weigh 183.54 grams and 100 cc. of water weigh 100 grams.

$$\text{specific gravity (sulfuric acid)} = \frac{183.54}{100} = 1.8354$$

The numerical values , it will be noted, for nickel (8.9) and for sulfuric acid (1.8354) are the same in either system, English or metric. This means that a solid piece of nickel will be 8.9 times as heavy as an equal volume of water and a volume of sulfuric acid in the above problem will be 1.8354 times as heavy as an equal volume of water at the same temperature.

In the metric system, one cubic centimeter (1 cc.) of water at 4° C. weighs one gram, and its density is one gram per cubic centimeter (1 g./cc. or 1 g./cm.^{3}). In the English system the weight in pounds at 60° F. of one cubic inch or one cubic foot of water would be respectively 0.0361 lb./in.^{3} and 62.37 lbs./ft.^{3} In the metric system density and specific gravity are the same, whereas the specific gravity for a substance in the English system is obtained by dividing the density of this material by 0.0361 if the value is expressed in fraction of a pound per cubic inch or by 62.37 if the value is in pounds per cubic foot. The same examples of nickel, density 8.9 and sulphuric acid, density 1.8354 will clarify this point.

Nickel:

$$\text{Metric system } \frac{8.9}{1} = 8.9 \text{ specific gravity}$$

$$\text{English system } \frac{0.322}{0.0361} = 8.9 \text{ specific gravity}$$

conversely

Metric system $8.9 \times 1 = 8.9$ gms./cm.^{3}

English system $8.9 \times 0.0361 = 0.322$ lb./in.^{3}

Sulphuric Acid:

$$\text{Metric system } \frac{1.8354}{1} = 1.8354 \text{ specific gravity}$$

$$\text{English system } \frac{114.5}{62.37} = 1.8354 \text{ specific gravity}$$

conversely

Metric system $1.8354 \times 1 = 1.8354$ g./cm.^{3}

English system $1.8354 \times 62.37 = 114.5$ lbs./ft.^{3}

Some values for commonly plated metals chosen from the GUIDEBOOK are given in table 1.

Table 1

(does not take into account porosity, inclusion, etc.)

	g./cm.^{3}	*lbs./in.*^{3}
Brass (80-20)	8.67	.313
Chromium	7.19	.260
Copper	8.96	.324
Gold	19.32	.698
Silver	10.49	.379
Zinc	7.13	.258

The specific gravity for a liquid or a solution may be determined in several ways. For accurate results a small bottle called a *pycnometer* is employed. The weight of water this unit holds at a fixed temperature is compared to the weight of a liquid or solution the pycnometer holds at the same temperature. The ratio of these two weights will give the specific gravity of the sample. It is understood that the weight of the bottle is subtracted in each case. If, for example, the weight of the water in the pycnometer is 50 grams and the same volume of liquid in the pycnometer gives a weight of 75 grams, then the specific gravity of the liquid

$$\text{would be } \frac{75}{50} = 1.5$$

For common plating operations specific gravity is determined by means of a hydrometer. In construction it is a cylindrical glass tube weighted on the bottom so that the center of gravity will be lowered and the stem will float in an upright position when immersed in the liquid. A scale is enclosed in the stem with properly marked divisions for the specific range for which the hydrometer is designed. The scale will also indicate the temperature at which readings must be made. When the instrument is immersed in the sample it will sink until it displaces a volume of liquid equal to the weight of the hydrometer. If the liquid is denser (heavier) than water it will not sink as low as it would in water to displace the same weight of liquid. For liquids lighter than water, the hydrometer will sink to a lower mark than

that indicated for water to displace the volume of liquid equal to the weight of the hydrometer. The line at which the instrument floats in water is marked 1.000. For hydrometers designed for liquids heavier than water (specific gravity greater than one) this mark is at the top of the stem; for liquids lighter than water the scale is marked 1.000 near the bottom of the stem.

The Baumé hydrometer, the most commonly used scale, does not indicate the specific gravity of a liquid or a solution. The reading on its scale must be converted to specific gravity. This can be done by a mathematical formula introduced by the *National Bureau of Standards*.

For liquids lighter than water (temperature 60° F.):

$$\text{Degrees Baumé} = \left(\frac{140}{\text{Specific gravity}} \right) - 130$$

A separate Baumé scale is used for liquids heavier than water, (temperature 60° F.). The conversion formula is:

$$\text{Degrees Baumé} = 145 - \left(\frac{145}{\text{Specific gravity}} \right)$$

Tables containing the complete range of equivalent values of Baumé readings and specific gravity are available in common references.

A solution composed of 15 parts by weight of salt (NaCl) and 85 parts by weight of water (a 15% solution) is the basis for this scale. The mark to which the hydrometer sinks in this solution is marked 15 and that in pure water is marked 0. The distance between the two points is divided into fifteen equal divisions. This same spacing is then used to mark off the entire stem, thereby providing an instrument for liquids heavier than water.

For liquids lighter than water a ten per cent salt solution is used with the mark 0 for the level to which the hydrometer sinks in this solution and the mark of 10 for the point to which the instrument sinks in pure water. This spacing is divided into ten equal divisions and this same division is continued for the entire stem.

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SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Chromic Acid Anodizing

Question: The requirements for governmental specifications on the chromic acid anodizing solution are in the METAL FINISHING GUIDEBOOK, but the composition of the solution on Military Specification MIL - A-8625 (ASG), dated 11 August 1953, which I have obtained from the Air Force, is chromic acid—10%, sulfuric acid —80 grams per liter. This specification does not correspond with the formula in the GUIDEBOOK.

What, actually, is the effect of sulfuric acid in the chromic acid anodizing solution, and can it be removed when present in excess?

Y. K.

Answer: The chromic acid anodizing solution is operated with not over 10% chromic acid. As the amount of dissolved aluminum increases, the chromium is sequestrated as a complex, the pH increases and it is not possible to obtain a suitable anodic film or to maintain the specified current density at the required voltage.

The bath is controlled by partial dumping or solution and replacement with fresh chromic acid, by using an ion-exchanger to remove the aluminum and trivalent chromium, or by addition of sulfuric acid to maintain the proper current density. The latter method was originally suggested as a conservation measure during a period of chromic acid shortage and is not generally employed today. When the sulfuric acid content exceeds the specified 80 g./l., the excess can also be removed by dumping part of the solution or by ion-exchange.

The mixed chromic-sulfuric anodizing bath can be employed for every purpose that the chromic acid bath is used, namely for alloys with less than 5% copper or less than 7.5% of total alloying elements.

Hamilton Gold

Question: We have heard that in the U.S.A. fancy jewelry is being covered with so-called "Hamilton" gold and it appears that this plate is particularly resistant. We subscribe to your journal and should be very much obliged if you would transmit us details of this process.

E. G. W.

Answer: Hamilton gold is a light shade of gold plate and would not be considered any more resistant than other gold alloy deposits containing copper and nickel. The prepared solution may be obtained from a number of suppliers. However, the following formula will give a good light yellow Hamilton color:

Metallic gold	3 dwt./gal.
Metallic nickel	1.5 grams/gal.
Metallic copper	0.5 "
Dipotassium phosphate	2.0 oz./gal.
Potassium cyanide	1.3 "
Temperature	150-160 deg. F.
Voltage	5-6

The metals are added as the cyanide salts.

For a pinker color, use 4 grams of copper and 1.5 oz. potassium cyanide instead of the above. For a greener shade, omit the copper in the above formula and substitute 0.2 grams silver per gallon.

Chromium Plating Chinaware

Question: We have quite a few calls for chrome plating on chinaware and we looked up a few formulas, but none of them were successful enough. Can you help us with this problem, please?

A. V. K.

Answer: Chromium deposits on chinaware can be produced by first applying a firing paint which provides a conducting and adherent base. The painted and fired paint is copper plated and buffed, then nickel and chrome plated as usual. Information on suitable paints will be found in the book "Metallizing Non-Conductors" by Samuel Wein.

If the glaze on the china is defective in spots, these areas will absorb the chromium plating solution and show a yellow stain which is very difficult to remove.

Silver Plating Brass

Question: I am having considerable trouble in plating silver on brass parts. One of my troubles is the complete coverage of the part in the strike bath. It sometimes has a spotty appearance where the plate does not adhere. From what I have read, this is caused by poor cleaning and this is how I have been processing the parts:

1. Buffing to bring the part to a mirror finish, wiping with lacquer thinner to remove buffing dirt.
2. Dip for 30 seconds in a degreasing bath made up of 4 oz. sodium cyanide, 1½ oz. lye per gal. at boiling.
3. Dip 1 minute in bath of 4 oz. sodium cyanide, cold.
4. Strike in bath made up of 0.5 oz. silver cyanide, 8 oz. sodium cyanide at about 2 volts. Bath is cold.
5. Plate in bath made up of 2.5 oz. silver cyanide, 3.5 oz. potassium cyanide, 2.0 oz. potassium carbonate, 2.0 oz. lye per gal. about 2 volts. Bath is cold.

When the parts come from the plating bath, they have a rough dark gray color and a heavy coating of something

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Close up of Lea-Engineered Spray Buffing System using Lea Liquabrade on side buffing

Sectional view of 18 head straight line automatic showing progression of stainless iron bodies through various spray buffing positions.

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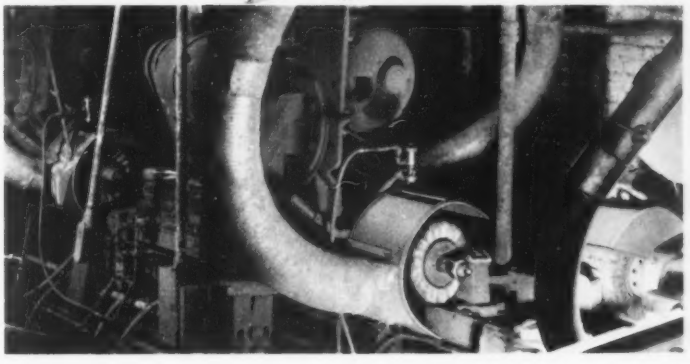

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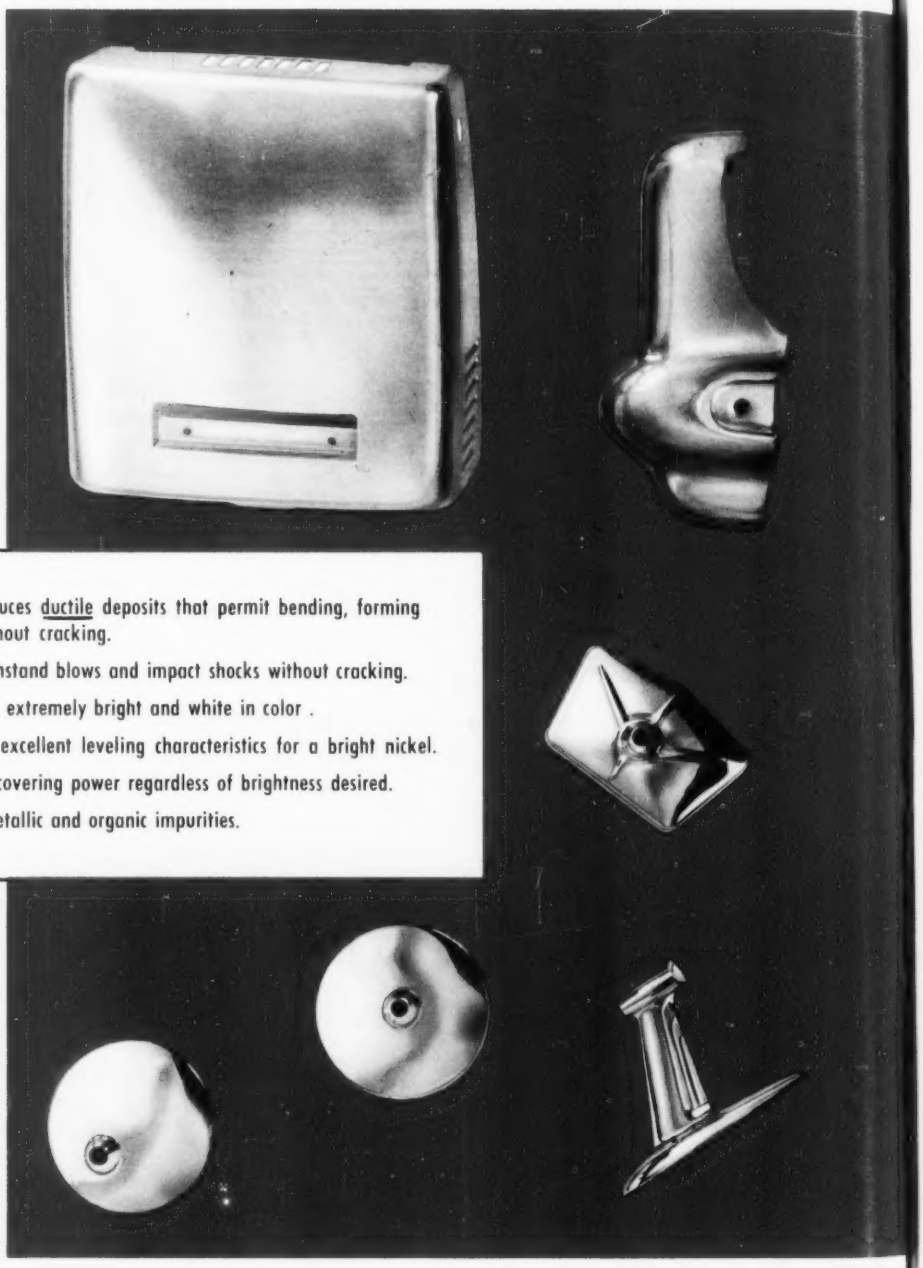

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that can be wiped off with the fingers, leaving the strike plate exposed.

Would you please be kind enough to advise me of the proper procedure to follow and any bath makeup that would give good results.

R. M.

Answer: You should use a proprietary brass cleaner rather than the mixture of lye and cyanide which is not a good cleaner, and the silver strike should be operated at 6 volts.

Your operations are satisfactory, except that the silver plating solution should be operated at a low enough voltage to obtain a smooth deposit. We would suggest that you use ¾-1 volt and add an additional 3 oz./gal. potassium cyanide. Brightener should be used for best results.

Acid Silver Baths

Question: Do you have any information that might be available to us on acid silver plating baths? We are anxious to use an acidic bath as, in our process, we have a resist which we have found suitable in all respects with the exception that it will not stand up in a cyanide bath We are wondering if anything has been done with silver nitrate or along that line.

J. R. S.

Answer: Although acid baths containing silver nitrate will generally produce granular deposits, successful results have been obtained from acid citrate-iodide and from sulfate baths. The baths, however, are quite expensive because of the necessity for using large concentrations of iodide. Also, the color of the deposit may be somewhat yellow, although suitable in this case since the purpose is not ornamental. Typical formulas are as follows:

1. Silver nitrate ..... 4½ oz./gal.
   Sodium iodide ..... 70 "
   Citric acid ..... 8 "

Operate at room temperature and 10 amperes/sq. ft

2. Silver nitrate ..... 5½ oz./gal.
   Potassium iodide ..... 75 "
   Sulfuric acid ..... ⅓ "

Operate at room temperature and about 1-1½ volts. This bath has been stated to give whiter deposits.

Bright Finish Without Polishing

Question: We manufacture brass (stone) chain and cast lead-tin jewelry. We want to get a high polished finish without polishing. Is it possible to use a metallized lacquer which would give the pieces a high polish which we could than plate nickel and gold? We know about vacuum metallizing, but the equipment is expensive and not suitable for brass chain.

M. L.

Answer: The most economical method of finishing these articles without polishing is to barrel burnish, then apply a bright copper and bright nickel plate in the case of the lead-tin. The bright copper plate can be omitted in the case of brass After bright nickel plating, the usual flash of gold can be applied. Bright nickel cannot be applied directly to a conducting lacquer.

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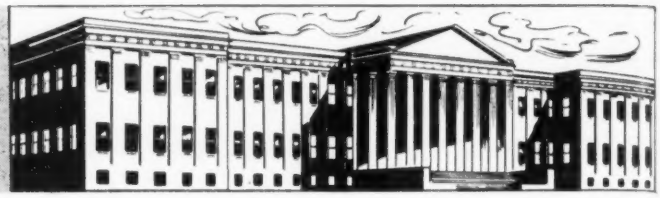

Gas Plating

U. S. Patent 2,704,728. *Mar* 22, 1955. *P. Pawlyk, assignor to The Commonwealth Engineering Co. of Ohio*

A process of plating a metallic object with copper comprising the steps of heating the object to be plated to a temperature in the range of 500 to 650° F. and contacting the heated object with gaseous copper acetylacetonate in an atmosphere containing an inert carrier gas at substantially atmospheric pressure and a temperature range of between about 300 to 450° F., and for a time sufficient to cause decomposition of said copper acetylacetonate and deposition of the copper metal onto said object

Engine Carbon Removal

U. S. Patent 2,704,733. *Mar.* 22, 1955. *H. W. Pearsall, assignor to General Motors Corp.*

The process of removing deposits from combustion chambers of internal combustion engines which comprises heating the coated parts to a temperature above 150° F., applying to the deposits a solution consisting of approximately 33⅓% by volume of xylene, 33⅓% by volume of high-flash aromatic naphtha boiling between 250° F. and 400° F., and 33⅓% by volume of dimethyl formamide, and removing the loosened deposits.

Composite Brush

U. S. Patent 2,704,854. *Mar.* 29, 1955. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

The method of manufacturing a composite bristle and fabric brushing tool which comprises cutting two superimposed layers of slightly overlapping discs from strips of such fabric, slitting such fabric centrally of such discs to form tabs, turning back such tabs to form central openings through such discs, securing such superimposed discs together closely adjacent such central openings, inserting bundles of bristle material through such respective openings, spreading apart such superimposed layers to form a chain of tubular pleated fingers interconnected at their ends and each enclosing a bundle of bristle material, doubling such fingers about a wire retaining member adjacent their midpoints, securing such doubled fingers within a unitary channelform back, and circularizing such back to form a rotary brushing element.

Buff Construction

U. S. Patent 2,704,916. *Mar.* 29, 1955. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

An abrasive buff element comprising a metal channelform back and buff material retained therein and extending therefrom, said buff material comprising pairs of flexible fabric discs joined in their center regions and having circumferentially spaced stripes of abrasive material adhered thereto and extending to their outer peripheries, the radially inner ends of such stripes being spaced from such center regions, said discs being separated, except where thus joined, to form pairs of generally conical tubular pleated fingers with said discs being folded along radial lines intermediate such abrasive stripes thus to form such pleats, and an elongated retaining mem longitudinally disposed within said channelform back and overlying such pairs of fingers in their regions of joining to secure the same therein with the fingers of each pair extending in side-by-side relationship.

Gas Plating Apparatus

U. S. Patent 2,704,992. *Mar.* 29, 1955. *J. W. Schell, assignor to Erie Resistor Corp.*

In an apparatus for gas plating dielectric disks and the like, a heated platen for supporting a disk, an inlet passageway for directing a stream of metal compound carrying gas toward the platen so as to impinge against the disc carried thereon, an outlet passageway leading the gas back away from the disk, said passageways comprising inner and outer tubes, a gasket on the outer tube for making sealing contact with the disk and defining the area thereon to be coated, the inner of the tubes being spaced from the disk, a bell housing sealed at its center to the outer tube and having side walls surrounding the outer tube and the gasket and sealed to the platen to provide with the outer tube a closed annular chamber outside the gasket, and means for maintaining a controlled gas atmosphere in said annular chamber to prevent harmful leakage through the gasket into the outer tube.

Bright Dip for Aluminum

U. S. Patent 2,705,191. *Mar.* 29, 1955. *J. F. Jumer*

The method for chemically polishing the surface of articles formed from a metal consisting principally of aluminum and containing not more than 5 per cent of silicon which comprises the steps for forming an aqueous bath containing 0.5-30.0 grams sodium nitrate and 0.25-10.0 grams of sodium sulfate dissolved in 100 cc. of 75 per cent phosphoric acid, maintaining the temperature of the bath at 150°-275° F., bringing the surface of the aluminum article to be polished into contact with the bath, dipping the article after treatment in a nitric acid bath and rinsing the article with water.

Cleaning Aluminum

U. S. Patent 2,705,500. *Apr.* 5, 1955. *L. L. Deer*

The process of removing surface oxides from aluminum having alloying constituents, said process comprising combining the oxide with a fluorine-containing solution to produce a film of fluoride salts of the base metal on aluminum, rinsing in water, and then immersing in an aqueous bath containing a chromic acid and an alkali sulphate.

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Plating Crankshafts

U. S. Patent 2,706,174. *Apr.* 12, 1955. *H. R. Wells*

An apparatus for simultaneously electroplating the main journal surfaces and a plurality of axially aligned connecting- rod journal surfaces of a crankshaft, comprising in combination, a container for the plating bath, means for suspending and turning a crankshaft about its main axis within the plating bath, movable anodes having elongated flat parallel arms spaced apart for straddling individual journal surfaces, means supporting and moving the anodes with an oscillating motion about a fixed axis parallel to the suspended crankshaft axis, said means including a supporting bar for a plurality of anodes positioned adjacent to aligned journal bearings, means rigid with each said bar and for connection with the crankshaft so as to follow the path of revolution of an aligned set of journal bearings and to effect the oscillation of the supporting bar so that each anode may move in constantly spaced relationship to its associated journal bearing as it revolves, anodes arranged for positioning adjacent to and spaced from each main bearing, and current-conducting elements connected with the crankshaft and all of said anodes.

Internal Plating of Tubes

U. S. Patent 2,706,175. *Apr.* 12, 1955. *C. L. Licharz, assignor to Electro Metal Hardening Co.*

An arrangement for electroplating the inner surface of a tubular article, comprising in combination: a hollow anode having a closed end and an open end for connection with the electrolyte supplying means, first end wall means having its major surface transverse to the longitudinal axis of said anode and being connected to said anode adjacent said closed end thereof, second end wall means having its major surface transverse to the longitudinal axis of said anode and being connected to said anode adjacent said open end thereof, said first and said second end wall means being arranged to receive therebetween the tubular article to be electroplated and tightly closing the open ends of said article so as to form with said tubular article and said anode a chamber for receiving an electrolyte from the interior of said anode, said anode having a smooth outer wall and being provided with passage means intermediate said first and second end wall means and arranged only in substantial proximity to said first end wall means and extending from the inside of said anode to the outside thereof for conveying electrolyte in substantial proximity to said first end wall means from inside said anode to said chamber, and electric current conducting means connected to said article and at least one end of said anode, said second end wall means being provided with passage means extending therethrough for withdrawing electrolyte from said chamber whereby the electrolyte is led through the interior of said anode in one direction of flow, thereby efficiently cooling said anode, and then passes through said passage means into said chamber in counterflow to said one direction.

Plating Crankshafts

U. S. Patent 2,706,173. *Apr.* 12, 1955. *H. R. Wells and F. P. Gill*

An apparatus for electroplating of crank throw connecting-rod-journals of a crankshaft, comprising a container for a plating bath, means for suspending the crankshaft vertically in the bath in the container, means for rotating the crankshaft on a vertical axis when so suspended causing its throw journals to revolve in circular paths, a vertically extending bus-bar parallel to the crankshaft, a pivotal supporting means for the bus-bar, an anode fixed to the bus-bar and having a flat surface parallel with the vertical axis and with the side of a journal surface and extending vertically along the same and spaced therefrom, a nonconducting element extending along and fixed upon each anode arm and having a straight knife edge portion projecting from the anode and positioned to contact the journal surface being plated, said edge being parallel to the anode arm, and the length of the anode surface being sufficient to follow the circular path of the journal surface and maintain its adjacent plating relationship.

Corrosion Prevention

U. S. Patent 2,703,784. *Mar.* 8, 1955. *E. K. Fields, assignor to Standard Oil Co.*

A new composition of matter, the reaction product of an aldehyde, a mercaptan selected from the class consisting of an aliphatic mercaptan and an aromatic mercaptan and 2, 5-dimer-

capto-1, 3. 4-thiadiazole, said reaction product having corrosion inhibiting properties and being suitable for addition to oils to impart corrosion inhibiting characteristics thereto, said aldehyde, mercaptan and 2, 5-dimercapto-2. 3, 4-thiadiazole being reacted in the molar ratio of from about 2:2:1, respectively, to about 10:2:9, respectively.

Stripping Deposits from Zinc

U. S. Patent 2,706,171. *Apr.* 12, 1955. *R. W. Goral and R. Goral, assignors to Enthone, Inc.*

The process of electrolytically stripping off metal platings of the group consisting of chromium, nickel, copper and mixtures thereof, from articles made of alloys consisting principally of zinc, which includes the steps of: preparing a bath consisting essentially of from 10% to 30% phosphoric acid by weight, from 30% to 55% sulfuric acid by weight, chromic acid in a concentration from 0.1% by weight to saturation, and the balance water; making the articles anodes in said bath; and subjecting the articles to electrolytic stripping to remove all of the metal platings therefrom and to form a protective film on the zinc effectively protecting the zinc from corrosion during its immersion in said bath.

ABSTRACTS

Pointers in Analysis of Copper and Nickel Plating Baths

W. Nohse: *Metallwarenindustrie und Galvanotechnik.* Vol. 45, No. 10, p. 506.

It is important to give full details of analytical method because, although the general details will possibly be familiar to an analytical chemist, they will be not so familiar to an ordinary plating technician seeking to apply bath control procedures.

The Low method for determination of copper by titration in copper baths is considered. It has been stated that the end point of the titration is taken when the solution does not again become blue within half a minute. This endpoint is, however, too uncertain. According to the author's experience, the endpoint is reached if the color of the drop falling into the titration beaker is no longer different from the color of the solution. This statement is based on experience obtained with about 10,000 copper determinations. Free iodine present in the potassium iodide solution can be recognized by a light brown coloration of the KI solution, and the copper determination will, as a result, be too high. Before titration, one can test a part of the potassium iodide solution with 10 cc. H_2SO_4 (1:3) and 10 cc. of 1% starch solution. No blue coloration should occur.

With nickel determination by the Sutton method it has been stated that the end point of the titration is reached when the solution remains clear. In the author's experience, two clear points can easily occur, apparently connected with the amount of excess ammonia. Only as much ammonia should be added for the test so that the smell of the ammonia can just be perceived. With the first clear endpoint, the solution is weakly yellow colored and becomes cloudy again with vigorous agitation after half to one minute. The titration is then proceeded with, requiring a few tenths of a c.c. and the endpoint is found when the solution, which has again become clear, has a yellow-brown tone. Renewed clouding sets in only after some minutes.

Antique Colors on Brass

Metallwarenindustrie und Galvanotechnik. Vol. 45, No. 10, p. 507.

The procedure for obtaining the desired color on brass had been to clean, scratch brush, and then dip 1-2 times with intermediate scratch brushing. This gave a pleasing, uniform coloration and 4-5 workers were able to finish 600-850 parts per day. Production methods were then required to be altered so that 2,000 parts per day could be finished with the same labor. The first attempts to raise production comprised degreasing, rinsing, and cleaning electrolytically for 30 sec. cathodic and 8 sec. anodic. The normal coloring treatment was then given (liver of sulfur—Schlipps salt, rinsing, copper sulfate + H_2SO_4), rub-drying, polishing (or scratch brushing). With this procedure, however, the parts were spotted and the finish was not comparable with the first process. Attempts to rumble the

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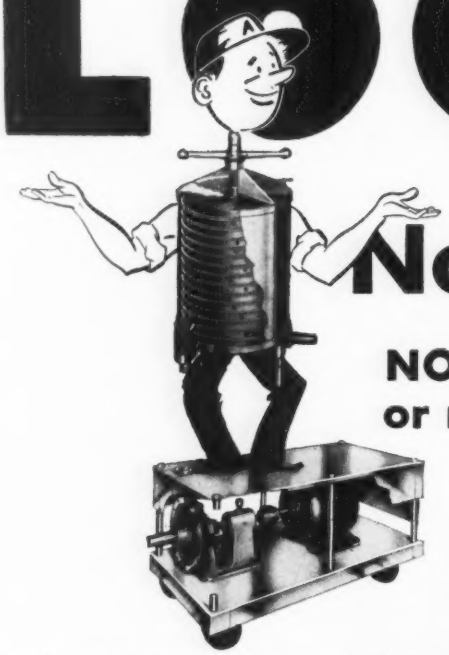

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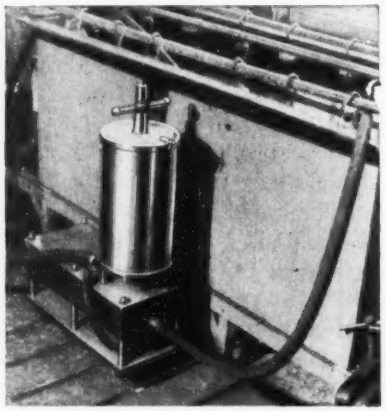

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brass covers in cleaner and pumice and to burn off the grease in an oven at 300°C. also gave poor results.

It was considered that the scratch brush stages were unnecessary. Previous experience had, however, established that these working stages could not be dispensed with if satisfactorily colored ware was to be produced. Tests which were made to replace the scratch brushing by pickling and bright dipping did not give the desired results.

The method recommended finally for the antique finish comprises the following: First, brass is most generally and in the cheapest manner, colored in liver of sulfur and acidified water. Scratch brushing is necessary, possibly at two stages to obtain a satisfactory finish. To cheapen the production process, tests were conducted as follows:

1. The parts were degreased in trichlorethylene solvent. The oxide skin was removed from the parts, which were then immersed for a short time in potassium cyanide until a clean surface appearance was obtained. The parts were well rinsed with ample water and immediately immersed in the acidified water, then rinsed in clear water, immersed in the liver of sulfur solution, then again rinsed and dipped once more in the acidified water. The ware was then toned with pumice, dried and given a light scratch brushing. A second test was made by treating the ware as above and then giving a second coloration.

2. A second procedure was tried as follows: The ware was given a preliminary cleaning as above. A paste of antimony pentasulfide and ammonia was then applied and the parts scratch brushed while still wet. This process is somewhat more expensive but is quicker.

3. A third test was made with an entirely new process. The method was as follows: A solution of caustic soda and antimony pentasulfide was brought to a boil and the brass articles were immersed for a short time. then toned with pumice. It was found that this provided the cheapest way to obtain the color which was somewhat darker in tone.

Characteristics of Tin-Nickel Plated Alloy Coatings

B. Keysselitz: *Metallwaren Industie und Galvanotechnik*. Vol. 45, No. 10, p. 492-493.

Tin-nickel alloy coatings are extraordinarily resistant to corrosion. Pore-free coatings retain their brilliance on exposure to air and behave just as well or better than chromium on nickel.

Tin-nickel is electrochemically more noble than steel and less noble than copper. As it is difficult to obtain coatings which are perfectly pore-free unless the deposits are unusually thick, it is sound practice before the application of a tin-nickel coating, to copper plate the steel first. The copper coating should not be less than 0.013 mm. thick.

The behavior of tin-nickel alloy coatings has been investigated under a multiplicity of corrosion conditions. The coating is perfectly stable against foodstuffs including common salt. It is not attacked by dilute mineral acids, and only to a very small extent by concentrated nitric acid. On the other hand, it is attacked more strongly by concentrated hydrochloric and sulfuric acids.

Against other corrosive media, with one or two insignificant exceptions, the tin-nickel alloy has shown itself to be considerably more resistant than either tin or nickel. Brass test pieces with a coating of 0.013 mm. tin-nickel, which were exposed for a year to the exterior atmosphere in semi-industrial surroundings, did not discolor at all; a few corrosion places had merely formed at pores.

The hardess can exceed 650 Vickers. The electroplated tin-nickel alloy is a monophasic, metastable compound of the approximate formula NiSn. The alloy is practically stable at room temperature. It begins to recrystallize at around 325°C. With this there occurs a volume change so that, particularly with thicker coatings, the recrystallization can lead to a disintegration of the coating. The operational temperature should not be above 300°C. for a lengthy service life. On heating above the recrystallization temperature, the coating begins to melt at about 800°C. and it is completely molten at 1,240°C.

The tin-nickel alloy is an inter-metallic compound and, in consequence, is somewhat brittle. This brittleness does not adversely affect its applicability. For example, a 0.3 mm. thick coating on steel can be ground without cracks occurring. Under practical conditions of usage, peeling or flaking because of brittleness has never been established. Because of the brittleness it is not advisable, however, to apply any working or shaping process after the application of the coating. It should also be mentioned here that tin-nickel coatings have no internal stresses. As a consequence, despite the brilliance of the coating, there exists no danger of a sudden cracking or a peeling away from the base metal, as is the case with many other bright plating coatings which are not free from stress.

Hard Iron Plating

E. Raub and B. Wullhorst: *Forschung Bericht Nordrh-Westf.* No. 56 (1953).

According to the investigations which were conducted on this subject, hard iron deposits in many respects show a similar behavior and similar characteristics to hard chromium deposits. The hardness attains that of hard chromium. Also, the hardness changes on heating are not very different from those with chromium. The deposits are resistant to impact and shock and are insensitive to temperature fluctuations. The process offers the possibility of preparation of adherent deposits of considerable thickness on various metals.

The characteristics considered do not, however, allow of conclusions being drawn as to what extent the practical behavior is equivalent to that of hard chromium and as to whether in given applications the hard iron deposit will give the same service as a hard chromium deposit.

These hard iron deposits have the chemical characteristics of pure iron. Because of lattice disturbances it can be assumed that the hard iron plate is somewhat more impure than pure iron which is obtained with normal iron plating processes. In no case, however, is the chemical stability greater than that of normal iron. As a consequence of this, from first considerations a hard iron plated deposit cannot be considered for those applications where, in addition to hardness and wear resistance, rust resistance is also a requirement of service.

In practical operation, the iron plating baths are not entirely bother-free. In particular, a disturbing influence is the tendency of the ferrous ions to oxidize to ferric ions. The trivalent iron which is formed does not remain in solution but hydrolyzes to ferric hydroxide, which is precipitated. On the surface of the solution there is soon formed a skin of ferric hydroxide. The processes which are associated with the oxidation of the divalent to the trivalent iron also strongly facilitate the adhesion on the cathode surface of the hydrogen developed during plating. Because of this, there is a distinct tendency towards pore formation as in the case of nickel plating and which can give rise to pitting troubles.

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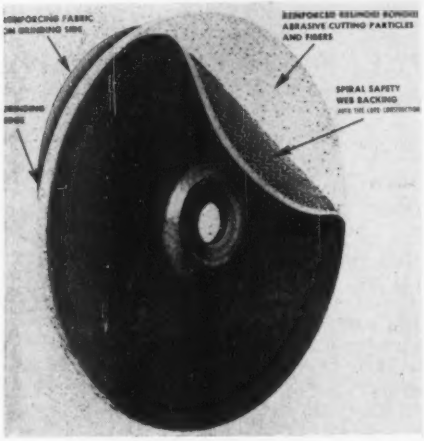
Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Extra Strong Abrasive Wheels for Portable Grinders

Simonds Abrasive Co., Dept. MF, Tacony and Fraley St., Philadelphia 37, Pa.



A novel construction feature imparting extra strength and safety to high speed abrasive wheels is a special safety web backing of spiral wound rayon auto tire cord.

Simex Red Wheels are a lightweight, rigid type reinforced resinoid bonded abrasive wheel for use on portable disc type and right angle type portable grinders. They are made in depressed center or raised hub shape in 7" and 9" diameters by $\frac{3}{16}$" and $\frac{1}{4}$" thicknesses. Their fast abrasive cutting action permits heavy stock removal and their durable construction gives extra long wheel life. They are claimed to outlast conventional abrasive cloth discs as much as 40 to 1, with resultant time and labor savings due to fewer wheel changes.

The wheel itself is more than a laminated priduct. It is made like a conventional grinding wheel, from a wheel mix consisting of abrasive cutting particles and synthetic resin bonding agents, reinforced with alpha cellulose fibers criss-crossed and knitted together throughout the wheel mass. In addition to the extra safety web backing on the top side the under, or grinding, side is further strengthened with a layer of reinforcing fabric. This combination provides equal and added strength in all directions of force applied on the wheel. There is a knurled or file-type pattern on the grinding or cutting side of the wheels to increase their cutting action.

The above manufacturer has issued Catalog Bulletin Form ESA-244 containing complete descriptive information and listing sizes and specifications available.

Barrel Deburring Compound

Lord Chemical Corp., Dept. MF, 2068 S. Queen St., York, Pa.

Where fast deburring and stock removal are to be accomplished in a short time, it is claimed that Lorco "QC" (quick cut) will do the job. This fine-grain abrasive compound for precision barrel finishing will cut as much as any other abrasive-type compound during the first two to five hours but should not be used where runs longer than six hours are necessary.

The compound is stated to produce a smooth finish and good color. It is used with abrasive chips, generally at low water level, and is also ideally suited to the self tumbling of small parts.

New Electronic Humidity Controller

American Instrument Co., Inc., Dept. MF, Silver Spring, Md.

A small, low-priced electric hygrometer humidity controller, known as the Humistat, automatically operates large or small humidifiers, dehumidifiers, and air conditioners to maintain humidity control within plus-minus 1.25% relative humidity. The device is so sensitive that the moisture from a person's hand will operate it.

For maximum sensitivity and versatility, the relative humidity range of 5% to 95% is covered by individual sensing elements with operating ranges of about 15% relative humidity. Humidity control settings within each element range are made in a few seconds by means of a novel simple technique. A calibrated resistor is plugged into the device and a potentiometer knob is turned until a click is heard. It is thereby set for a specific humidity control point independent of the sensing element and without recourse to calibration devices.

The controller employs the Aminco-Dunmore electric hygrometer sensing element, over 100,000 of which are in continuous world-wide use. The sensing element is mounted inside the case for maximum compactness. The complete controller is about the size of a quart carton of milk. Accessories include sensing element mountings for sealed enclosures and cables for remote mounting of the sensing element.

All models incorporate failure-safe features. Some models provide additional relay contacts that operate an alarm light when a change of 3 per cent relative humidity from the control setting is reached.

Descriptive Bulletin 2273 is available from the above manufacturer.

All-Purpose Tumbling Chips

Lord Chemical Corp., Dept. MF, 2068 Queen St., York, Pa.

One chip does it all, rough cut, fine

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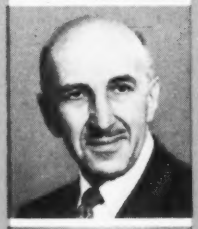

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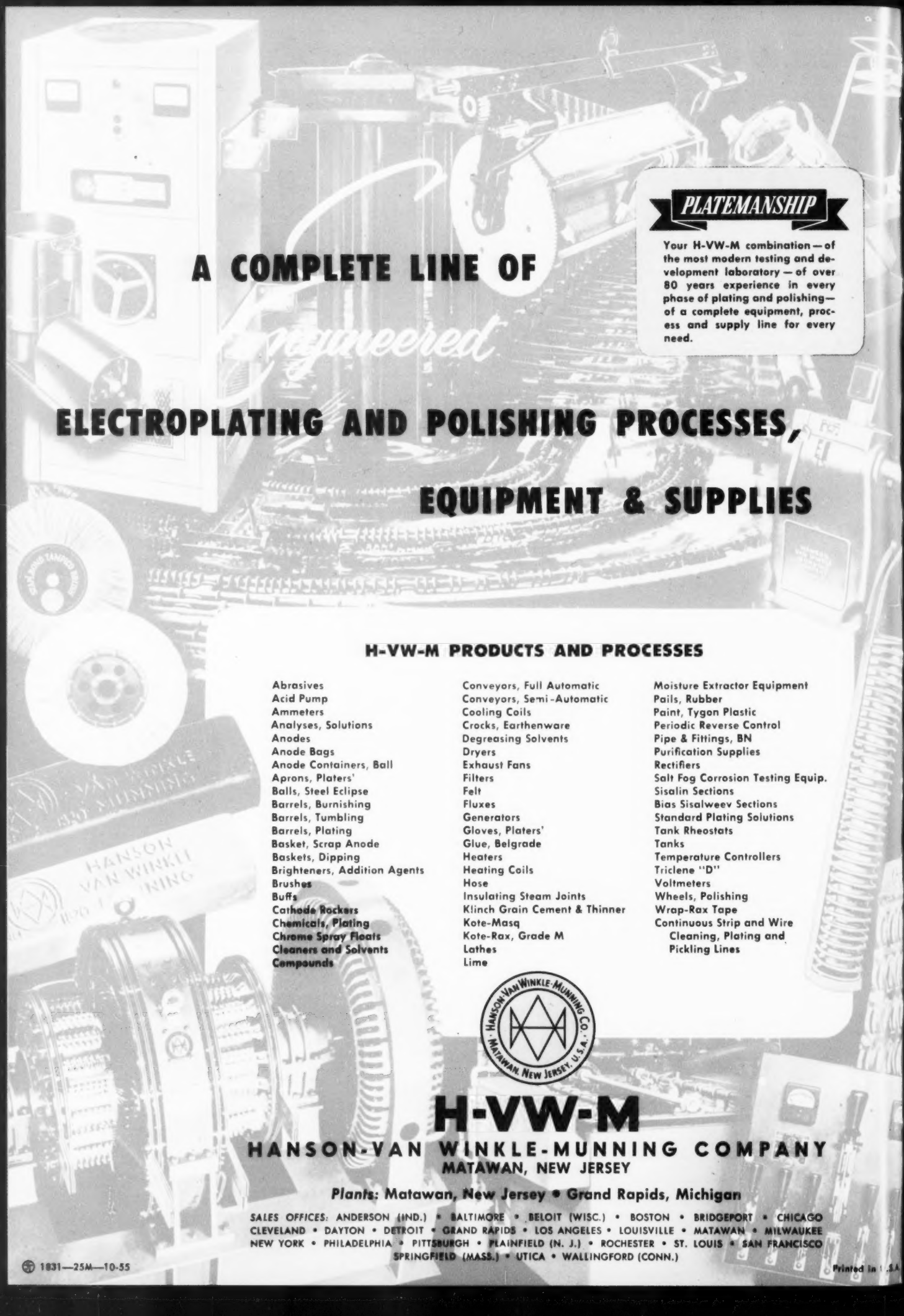

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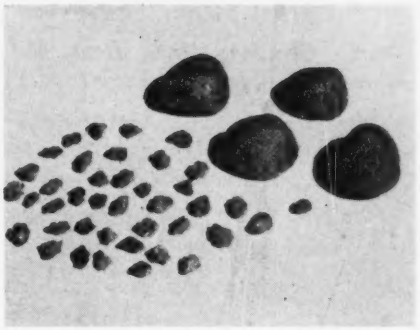


finishing, coloring, and burnishing. The new Lorco fused aluminum-oxide chip can be transformed into an excellent medium for coloring and burnishing, it is claimed.

For cutting, the fine pores of the chip must be kept from becoming glazed or loaded. Cleaned as recommended by a two-minute tumbling with compound "GW," the chip will retain its original sharpness until it wears down to fine dust. Other compounds are used to load the pores deliberately. In this condition, the chip will burnish as well as, or better than steel balls, according to the supplier.

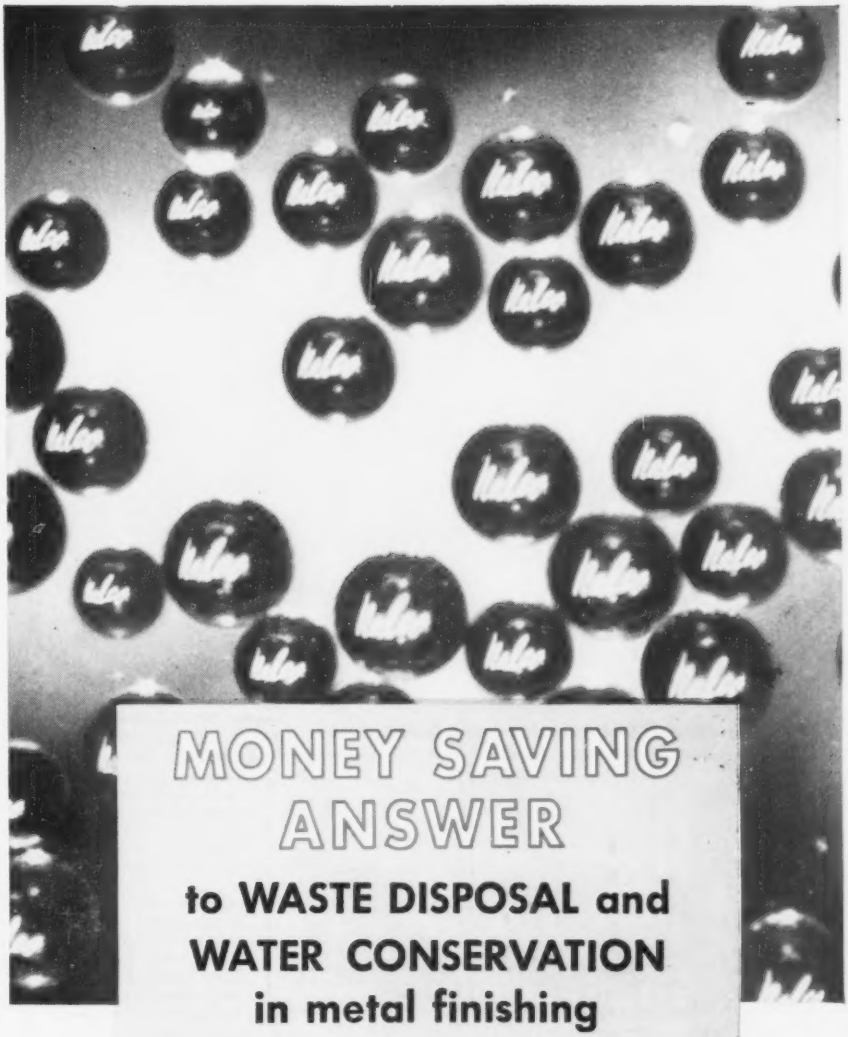
The chips are screened to range downward in sizes from 00 (2"-1½") to particles like grains of fine sand. Better and closer sizing for precision finishing has been provided by the addition of three extra half sizes: 1½ (⅞"-¾"), 2½ (⅝"-½") and 3½ (⅜"-0.279"). Below 3½, the grain sizes follow the standard mesh sizes of the U. S. Bureau of Standards down to No. 16 and even finer.

Ordinarily, an aluminum-oxide chip must be pretumbled by the user for 24 to 48 hours to remove the rough edges and produce the rounded blocky shape needed for fine finishing, coloring and burnishing. This necessary pretumbling is done as part of the above manufacturer's process with all chips above No. 7. Even grain sizes Nos. 4, 5 and 6 are delivered ready for immediate use.

Flexible Abrasive Wheels

Merit Products, Inc., Dept. MF, 4623 Irving Place, Culver City, Cal.

The above makers of the original Grind-O-Flex wheel, now have in production two large-diameter, 10" and 12" diameters in one- or two-inch widths. The larger wheels are designed for heavy duty light grinding, burr shagging, and polishing of flat or contoured surfaces; they are very light for their size, and may be used on



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Nalco Ion Exchangers can serve you two ways:

Cation exchange treatment of plating solution recovers chromic acid... assures nearly 100% use of chrome, and eliminates complaints about toxic wastes.

Deionization of rinse solutions recovers chrome and eliminates drag-out losses . . . provides pure, reusable water for a perfect spot-free rinse. Cost-wise, Nalco's recovery and reuse program will save you money.

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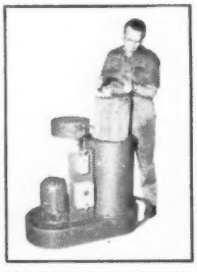
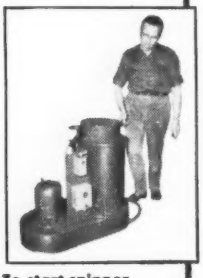
SAFER because of Mechanical and Electrical Control Features!

To unlock cover and remove basket, operator must depress foot brake, stop spinner.



Machine cannot start with open cover. Ample clearance allowed for quick loading.



To start spinner, operator must first close cover completely.

SPECIFICATIONS:

1 h. p. motor—220, 440, 550 volts—2- or 3-phase—spins 75-lb. loads at 825 r.p.m. . . . Quiet V-belt drive . . . 30-blade suction turbine draws air through spinner. . . . Arc-welded steel-plate construction . . . Heavy-gauge woven steel mesh basket . . . Weight: 490 lbs. . . . Floor space: Just under 5 sq. ft. . . . Meets N.F.C. specs. **Optional:** J.I.C. Control: Mounted on right, left side or wall. 160° supplementary heat: 2350-watt Chromalox, or steam.

Send for illustrated 4-page folder. Address Dept. MF-1155, New Holland Machine Company, New Holland, Pa.

NEW HOLLAND MACHINE COMPANY
NEW HOLLAND, PA.

light equipment or in automatic setups.

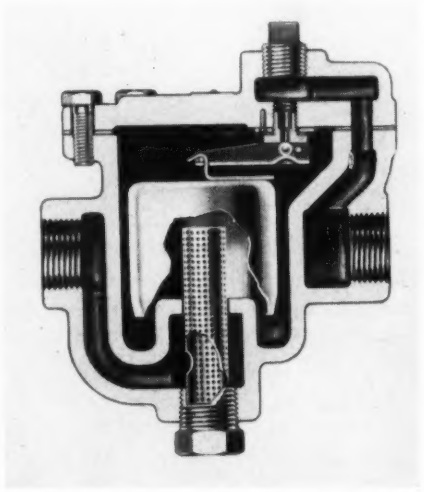
Available in a full range of grits (from No. 40 up to No. 320), they may be used in operations ranging from smoothing off flash to high polish operations. By the choice of the proper grit for the job, the required finish or light stock removal may be accomplished without danger of digging into the workpiece or flatting radii. Several wheels may be "ganged" on one spindle to cover a broad surface, each wheel flexing individually to follow contours.

Carrying their own grit load, they never require re-gritting and give a uniform "scratch" for their entire life which is extremely long, eliminating the necessity for frequent wheel changing or dressing.

The wheels are provided with flanges to fit any threaded spindle. They may be quickly mounted on grinders, buffers, motor shafts, polishing jacks or automatics.

Bucket Steam Trap

Sarco Company, Inc., Dept. MF, Empire State Bldg., New York 1, N. Y.



The possible loss of prime with consequent blow-through of steam is a well-known inherent weakness in all inverted bucket steam traps.

This manufacturer offers a new design which is claimed to be superior in retaining prime under the most difficult operating conditions: light loads, rapid pressure drops, and partial vacuum in the return line caused by night shut-downs.

Zinc Base Coating

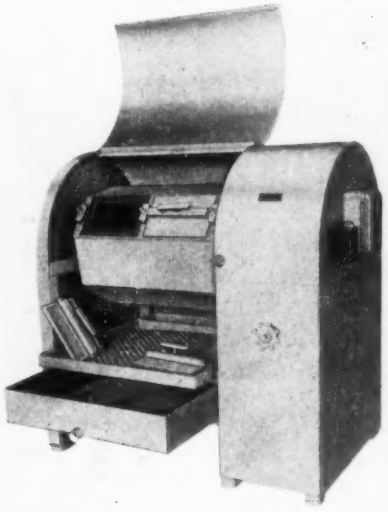
Amercoat Corp., Dept. MF, 4809 Firestone Blvd., South Gate, Cal.

Plant maintenance painters can now give existing steel structures the same protection that galvanizing affords with an unusual protective coating called Dimetcote. Not a paint, although applied with either brush or spray, the material is a 100% inorganic, metallic zinc coating that contains no oils or resins. Only one coat is required for most applications. The material cost is less than 6c per square foot.

Not only is the coating unusually resistant to severe weathering and abrasion, but it is unaffected by solvents and petroleum products, according to the above manufacturer. A unique feature of the coating is that the film cathodically inhibits corrosion of contiguous areas of bare steel. According to the manufacturer, when the film is applied, a reaction takes place at the surface which produces chemical bonding as well as physical adhesion, so that it is almost impossible to find the interface.

Deburring Machine

Metal Parts Sales Co., Dept. MF, 66 Chapel St., Newark 5, N. J.



This four cubic foot octagonal drum, totally enclosed in heavy gauge prime steel, is claimed to be ruggedly built and will not operate unless the safety hood is down.

The machine has variable speeds from 10 to 30 R.P.M., with speed reducer, chain and sprocket drive; reversible ¾ h.p. motor wired for 220 volts 3 phase 60 cycle current with magnetic starter, reversing switch, and safety switch. The drum measures 46" wide by 30" deep. Its height is 44", and it weighs 500 lbs.

It comes complete with adjustable door locks on the two solid covers and perforated drain door, a separating screen, and a chip storage pan with drainage plug. Safety micro switch also acts as a forward and reverse jog button.

Barrel Finishing Compounds and Media

Newton Industries, Inc., Dept. MF, 100 Saw Mill Road, West Haven, Conn.

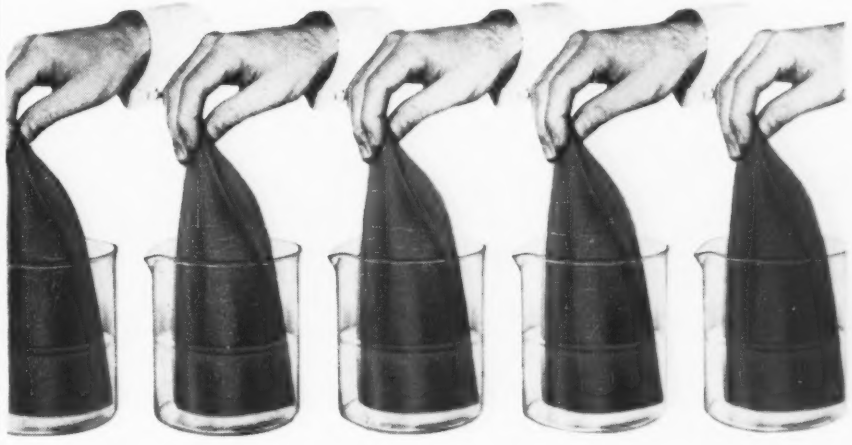
A complete line of abrasive, burnishing, cleaning, and neutralizing compounds includes four classes of compounds formulated specifically to meet varying requirements along progressive stages of barrel finishing operations. According to the above manufacturer, they will not paste, plug, or bind up tapped or blind holes when properly used.

Class A compounds for heavy deburring and cutting are used for initial stages of finishing, depending on the character of the metal, shape, size, and degree of finish required. Class B compounds for regular deburring and semi-burnishing can be used for follow-up finishing. Still other parts may require a third operation with Class C compounds for burnishing. As a last stage, Class D compounds for cleaning possesses wetting agents and dispersers which have a high detergency value and buffing action and contribute to finer metal color and finish.

Designed for use with all media types, the compounds are particularly effective with the firm's Polishapes and Burnishapes media, specially cast zinc alloy forms of specific size and shape. The elongated shape of the former performs the cutting and polishing on the larger work surfaces while the pointed ends carry the abrasive or polishing compounds into the holes,

Note how the Polishapes have made contact with all openings of the part and carry the abrasive compound for finishing.

SAFE for all baths



With Unichrome Coating 218X, plating and anodizing racks are fitted for long use. Leading bright nickel producers have approved this green plastisol because of its chemical inertness. Well known plants are cutting costs with it. It's one of the most widely used coatings in the industry.

Justly so. Coating 218X resists severest plating and cleaning baths, even vapor degreasing cycles. It rinses freely, sticks tight to contacts, won't chip, crack or blister.

Write for further information.

UNICHROME Trade Mark

materials · processes · equipment

for better plating at less cost

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METAL & THERMIT CORPORATION

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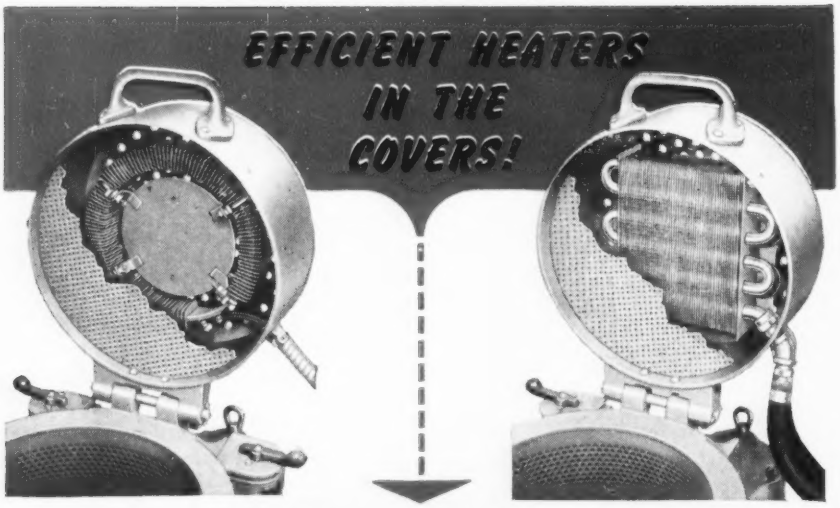
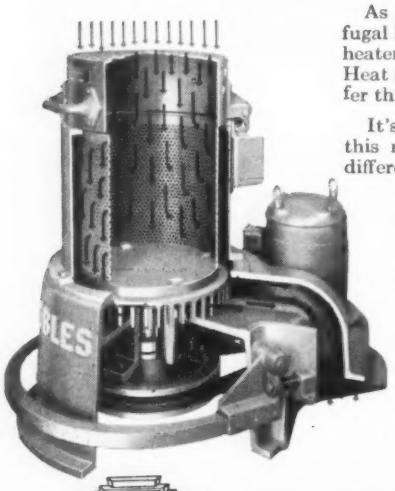
Detroit 20, Mich. • Waterbury 20, Conn.
E. Chicago, Ind. • El Segundo, Calif.
In Canada: United Chromium Limited, Toronto 1, Ont.



FOR LOWER DRYING COSTS!



As optional equipment with any Nobles Centrifugal Dryer, you may have efficient steam or electric heaters safely and compactly mounted in the cover. Heat doesn't come from an auxiliary unit and transfer through pipes . . . it saves space, saves heat.

It's only one of many features you'll like about this machine of advanced design. It's completely different in principle. The old way was to *blow* air down at the parts. A powerful suction fan *draws* the air from the bottom of the modern Nobles Dryer. Fresh air rushes in from the top to fill the vacuum, is drawn evenly through the entire contents and exhausted at the bottom.

You'll like its extra weight, its smoothness, its freedom from vibration. As one user put it, "Certainly it depreciates less and requires less maintenance than any competitive product."

In the interest of lower drying costs, write for more information today!

NOBLES ENGINEERING & MANUFACTURING CO.

ST. PAUL 6, MINNESOTA

Write Today for the FREE NOBLES-DRYER BROCHURE

recesses, and crevices. The perfectly spherical shape of the latter are ideal for burnishing operations.

The products are available through distributors and the manufacturer offers free consultation service on all precision barrel finishing operations.

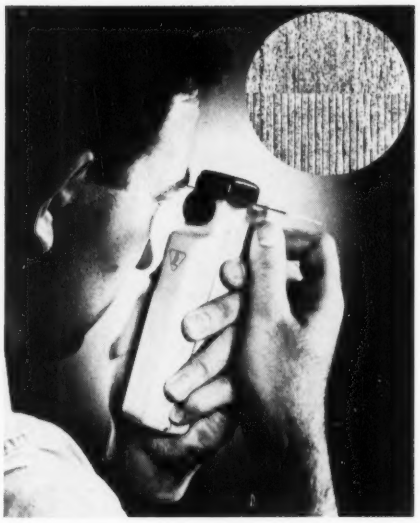
Surface Roughness Comparator

Bausch & Lomb Optical Co., Dept. MF, 625 St. Paul St., Rochester, N. Y.

A completely new approach to the problem of judging surface roughness of mass-produced parts has been announced. The new principle is embodied in an inexpensive surface comparator which permits metal surfaces to be compared with a selected standard for roughness under 10-power magnification.

A pocket-sized, hand-held instrument, the surface comparator operates on a unique optical principle which greatly emphasizes surface irregularities. It illuminates both the known standard and the piece under study. When looking into the 10-power eyepiece, the user sees a circular image, one half of which is the standard, the other half, the sample being checked. A comparison can thus be made quickly using commercial roughness standard strips, or samples of satisfactory work.

According to the above company, the instrument fills a long standing need for a handy, inexpensive tool to examine surfaces after milling, turning, grinding, planing, buffing, polishing, plating, painting, and lacquering.



Previously, production workers usually judged a metal surface for roughness by testing it with a fingernail, and then testing a standard block or roughness strip for comparison.

The instrument is self-illuminated with two pen-light batteries and a standard PR-4 flashlight lamp. It is made of a rugged die casting. The 10-power Hastings lens turns for individual focusing.

Illumination and viewing of the known standard and the work is achieved with a beam-splitting mirror. The standard comparison blocks are held in place by a spring-loaded clamp.

The instrument will be sold through industrial supply houses for $30.

Bond for Re-Concreting

The United Laboratories, Inc., Dept. MF, 16801 Euclid Ave., Cleveland 12, O.

An emulsified synthetic latex, Certified Cretite Bond No. 204, sets up an almost indestructible bond between old concrete, metal and wood surfaces and any newly applied water-mix surfacing material, according to the above manfacturer. The producer of floor and roofing maintenance products states that the material may be used both indoors and outdoors, over old concrete to supply positive bond on floors, sidewalks, walls, including materials of glass, metal, concrete, marble and others.

Use of the material is said to be very easy, as it can be applied by brush or spray. It secures a firm grip and dries dust free within several hours, and the finish surfacing application may be applied at any time up to six days. When the water-mix

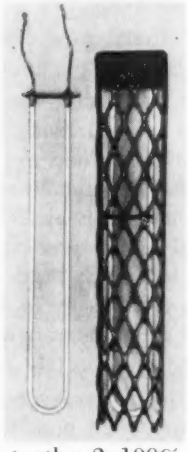
surfacing material is applied, the bond softens, then dries and cures with the surfacing material, the manufacturer states. Due to the non-porous nature of the synthetic latex material, a water resistant membrane is obtained between the old and new surfaces, so that capillary migration is greatly reduced.

Use of the bond is said to eliminate costly preparation work of chipping, drilling, acid washing, scarifying to obtain a strong bond. Depending upon the type and condition of surface to be treated, coverage runs between 80 to 100 square feet per gallon.

The product is available in one and five gallon quantities.

"U" Type Quartz Immersion Heater

Glo-Quartz Electric Heater Co., Inc., Dept. MF, Willoughby, O.



This new "U" type electric radiant translucent fused quartz immersion heater was designed to solve the difficult problems encountered in the heating of acid electroplating and pickling solutions.

Among the advantages claimed are: 1. Heats instantly; 2. 100% Short-proof construction; 3. 100% thermal and shock-proof construction; 4. Greater accuracy; 5. Longer life. It is fully protected by patent applications. The above manufacturer guarantees that the element will not burn out within a period of one year and should last several years under normal usage. Greater accuracy in controlling bath temperatures is claimed because there is virtually no thermal lag between thermostat and heater.

The heater consists of two interchangeable components: The "U" shaped quartz heating element and the combined junction box and guard assembly. The resistance heating element is mounted inside the quartz tube and the coil is firmly supported with a special heat-conducting powder. Hermetic sealing locks out acid fumes. The element rests, at the top, on a special Neoprene gasket which absorbs mechanical shock on the guard, thus protecting the tube from damage when it is mounted in the tank.

The new heaters are made in standard voltages and wattages and are available through leading electroplating distributors.

Canned Rotor Pump

Chempump Corp., Dept. MF, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

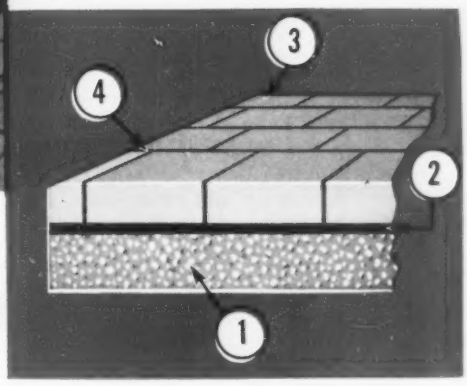
New methods of construction, new materials and a new cooling circuit are offered in the Model S series sealless centrifugal pumps. In addition, these new ⅓ through 3 horsepower leak-proof units are priced from $100 to $150 lower than their older but still available counterparts, the Model C series.

The new Chempumps utilize fabricated parts in their construction which can be clad with such metals as titanium, zirconium and Hastelloy series metals, as well as Monel, Carpenter 20 and the various types of stainless steels previously available. Corrosion resistant service on a much wider scale is therefore possible with the new series.

Approximately 400 per cent more bearing area is offered by the patented bearings developed for this new series. Made of Graphitar, these bearings are semi-floating and can be replaced from front or rear of the pump without special tools and without breaking piping connections.

Cooling for stator windings, rotor

Here's why this
ACID PROOF FLOOR
will last for
FIFTY YEARS
or more!



. . . and will cost practically nothing for maintenance

1. It is built on a rigid, solid sub-base — 4" to 6" thick.
2. The sub-base is protected by a thick corrosion-resistant "Resilon" membrane.
3. Over the membrane, a course of dense, tough, spall-resistant "USSCO" acid brick.
4. Bonded by wafer-thin, non-porous joints with "Durisite" acid-and-alkali resistant cement.

Yes, here's a corrosion-resistant floor that will outlast the building itself. Expensive? Savings in maintenance, alone, will make it over the years the lowest cost floor you can install.

Write for this free booklet!

Detailed construction drawings showing approved methods of building floors, trenches, gutters, tank and motor supports, etc., with full technical data, photographs and case histories. Ask for Bulletin AB-17.

PROCESS EQUIPMENT DIVISION

U. S. STONEWARE

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extra high quality

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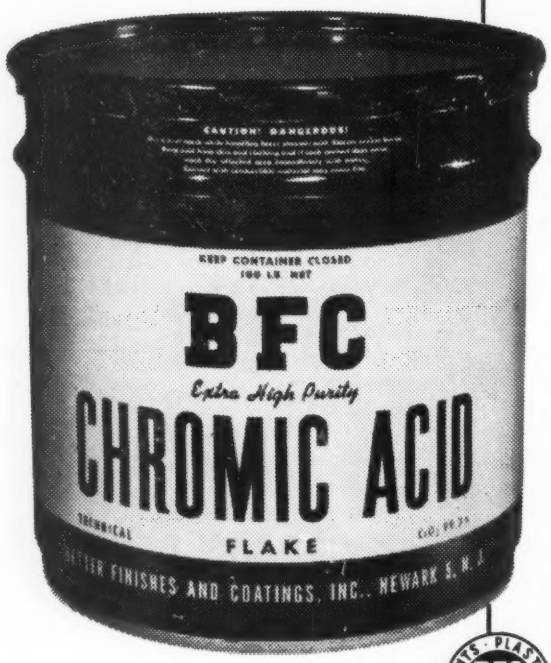
Every batch checked!

99.75% pure



It's a fact. We check the purity of every *batch* of BFC Chromic Acid by our own special test in a plant lab located only a hop-skip-and-a-jump away from the flakers. Not a drum moves from plant to warehouse until the lab says, "OK".

We don't know any better way than 100% check-testing to keep our quality up . . . and complaints down. Do you?

BETTER FINISHES & COATINGS, INC.

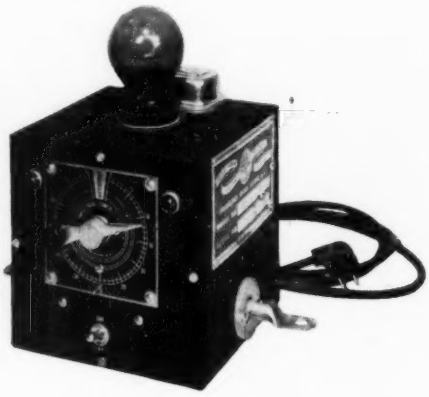
268 Doremus Avenue, Newark 5, N. J.

2014 East 15th Street, Los Angeles 21, Calif.

PAINTS · PLASTICS · CHEMICALS · BFC

Short Cycle Electroplating Timers

Technic, Inc., Dept. MF, Providence, R. I.



Improved new models of the Techni Timer for precision timing of short cycle precious metal electroplating are announced by the originators. Now streamlined, the automatic device is described as taking the guesswork and human error out of short cycle electroplating.

The timer does its precision work without interruption of current. It starts timing automatically when work contact is made, and automatically resets itself when work contact is broken, requiring no manual effort after the required time cycle is set. Expiration of the pre-determined time cycle is signalled by red light and buzzer.

Custom models of the timer are designed on order to meet any special requirements for short cycle precious metal plating. Standard timers immediately available from stock include 0-1 minute models with amperage load 8-45 or 18-100; 0-3 minute models with amperage load 8-40 or 18-100 and 0-5 models with amperage load 8-40 or 18-100.

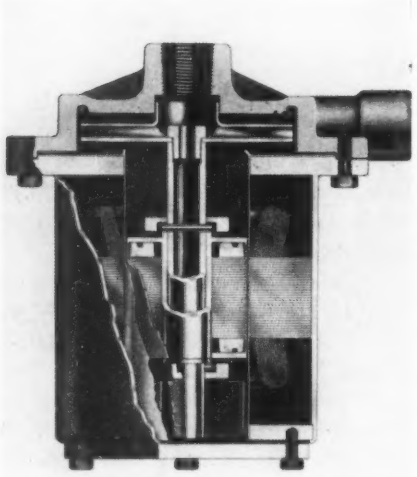
Humidity Test Cabinet

Labline, Inc., Dept. MF, 3070 W. Grand Ave., Chicago 22, Ill.

A new corrosion test humidity cabinet, for JAN-H-792, was developed to test effectiveness of corrosion preventative materials.

The cabinet operates at 120°F. and is approximately 28″ x 28″ deep, with immersion heaters, air manifold with diffusers, and revolving rack rotating at ⅓ R.P.M. holding 33 test panels.

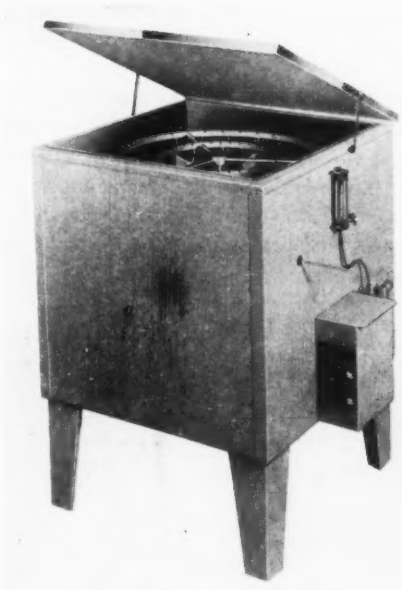
Cover is airplane cloth to permit exhausting of air, but retaining humidity in chamber. Dual thermostat provides complete safety of operation.



and bearings, as well as bearing lubrication is provided by a patented cooling and fluid circulation system. Pumped fluid passes from the pump chamber, through the front bearing, into the rotor chamber and through the rear bearing, returning to the eye of the impeller through the hollow rotor shaft. No external cooling circulation tube is used.

The new Model S series pumps offer users leak-proof corrosion resistant service at capacities to 170 g.p.m. and heads to 150 feet. Standard temperature and pressure limits are 350 degrees F. and 150 p.s.i.

Further information may be obtained by writing to the manufacturer at the above address.



Interior of chamber is tinned copper. Exterior is special marine plywood finished in enamel.

The unit may be used for all other types of humidity and temperature tests.

Gravity Conveyor

The Rapids-Standard Co., Inc., Dept. MF, 342 Rapistan Bldg., Grand Rapids, Mich.

A new type of lightweight gravity wheel strip conveyor, called Rapistan Flow Track, is available in two standard sizes, each with a choice of three wheel spacings for handling a wide range of materials.

An exclusive feature is the method of wheel mounting to give two-point axle support that provides maximum resistance to bending under loads. Hug lock nuts hold wheel assembly securely, and wheel bearings are lubricated for life to roll smoothly for years without maintenance.

A standard ten-foot section with supports on 5-foot centers has a distributed load capacity of from 400 to 750 pounds and weighs only 15 to 24 pounds for easy set-up and storage.

The new low-cost conveyor has wide application and can be used with other types of conveyor, may be mounted on stands, laid on the floor, or set on work benches to reduce manual handling.

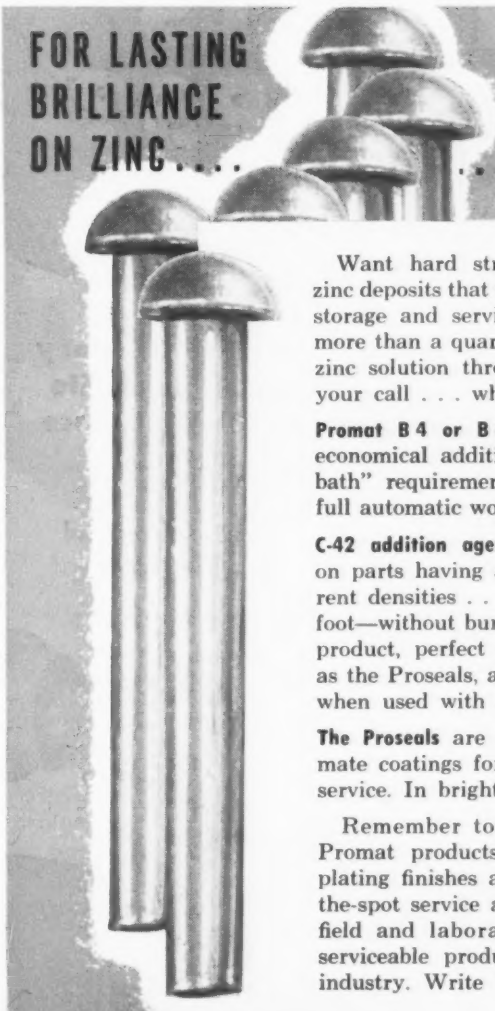
Eye Shield

Pulmosan Safety Equip. Corp., Dept. MF, 644 Pacific St., Brooklyn 17, N. Y.

Secureye Shield is lightweight and comfortable and provides a larger area of protection than is usually permitted by the average type goggle. Rigid and tough construction affords full eye protection against flying particles with exclusive replaceable foam rubber sweatband, it is available in transparent clear or transparent green non-shattering Lumarith.

FOR LASTING BRILLIANCE ON ZINC....

B 4 • B 4M .....and C-42



Want hard striking, durable, fine grained zinc deposits that will withstand tough handling, storage and service? Experience in operating more than a quarter million gallons of cyanide zinc solution throughout the free world is at your call . . . when you call PROMAT.

Promat B 4 or B 4M brighteners are effective, economical addition agents for bright "out of bath" requirements on barrel, still, semi and full automatic work.

C-42 addition agent permits uniform coverage on parts having a wide range of cathode current densities . . . up to 200 amps per square foot—without burning. Produces a fine grained product, perfect for secondary coatings, such as the Proseals, and bright "out of bath" work, when used with B 4 and B 4M.

The Proseals are durable, easily applied chromate coatings for extended life under adverse service. In bright, bronze or olive drab.

Remember too . . . the complete line of Promat products for metal preparation and plating finishes are backed by responsible on-the-spot service and are the result of years of field and laboratory research, dedicated to serviceable products . . . for an *enlightened* industry. Write for bulletin

PROMAT Division

Poor & Company

851 S. Market Street
Waukegan, Illinois

All-Steel Drop Bottom Box

Palmer-Shile Co., Dept. MF, 16035 Fullerton, Detroit 27, Mich.

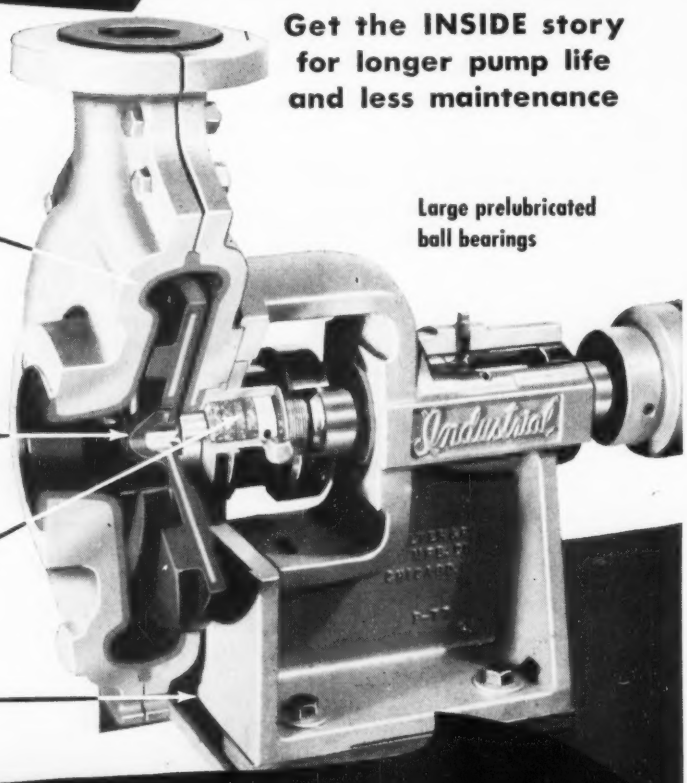
Important safety features have been incorporated into the design of these new corrugated all-steel welded drop bottom boxes. The boxes are made for use either with positioning stand or for controlled dumping by fork truck.

Safety corners prevent box shifting during stacking or when two or more are transported up or down grade by fork truck. Corrugated rolled steel legs on the bottom of the box lifting plate are reinforced with steel plate. Boxes also have lapped joints, replacing butt welds, for greater strength and safety.

WHAT KILLS YOUR PUMPS?

CORROSION...ABRASION...VIBRATION?

Get the INSIDE story for longer pump life and less maintenance


Heavy rubber or special linings molded in the case to resist corrosion and abrasion
Large prelubricated ball bearings
One-piece molded impeller and oversized shaft prevent oscillation
Easy access to corrosion-proof stuffing box
Rubber covered base
Industrial

Industrial RESISTS ALL 3

Lined to suit the job . . . the rubber formula most resistant to the fluids you handle can be supplied by INDUSTRIAL'S rubber compounding and lining division. Neoprene, Saran, Hypalon and Hycar are also available. INDUSTRIAL'S experienced chemists and engineers will help you select the ideal lining and pump size.

Wide range of sizes available with capacities to 450 gpm.

Write for 8-page bulletin with head, GPM and efficiency graphs.

RIFUGAL PUMPS · PRESSURE FILTERS · ION AND HEAT EXCHANGERS · RUBBER LININGS · WASTE TREATING EQUIPMENT

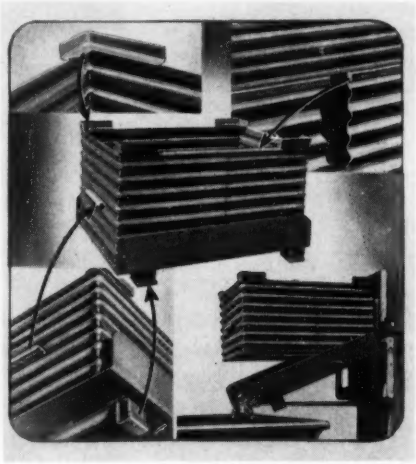
Industrial

INDUSTRIAL

FILTER & PUMP MFG. CO.

5906 OGDEN AVENUE • CHICAGO 50, ILLINOIS

When used on a positioning stand, the legs at the bottom of the box engage the stand and the drop bottom automatically opens to discharge materials into the stand tray. When used for automatic dumping by fork truck, a reinforced box hanger engages the mast of the fork truck for controlled materials discharge into a truck or conveyor.



Boxes have four-way entrances and are built from any gauge steel to customer dimension and capacity specifications.

Liquid Cadmium Brightener

Federated Metals Div., American Smelting and Refining Co., Dept. MF, 120 Broadway, New York 5, N. Y.

Cadmax, a new highly concentrated liquid brightener for barrel and still cyanide cadmium plating is claimed to be the first cadmium brightener to contain pure chemical compounds of known structure, eliminating breakdown products and organic impurities.

The low-foaming product will produce clear, brilliant, blue white deposits over an extremely wide range. Among other features claimed are: burning is prevented even with low cadmium metal content in the bath; permits the use of high throwing power baths without restricting the plating range; optimum results are produced with baths of very low nickel content, which eliminates staining problems encountered when baths with high nickel content are employed.

The new brightener is compatible with most organic brighteners currently available. Unless the bath being converted is in serious difficulty due to organic contamination, carbon treatment of the bath is not required.

The optimum concentration of the

new brightener for bath maintenance is one pint (diluted with one half gallon of water) for each 20 pounds of sodium cyanide. In some instances, only ¼ to ½ pint of the concentrate will suffice. The brightener is simple to control because the range of effective concentration is extremely wide, requiring only visual control of the work.

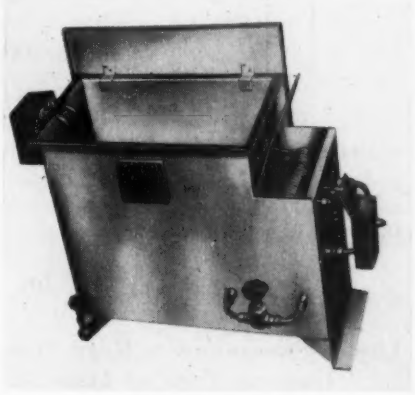
By using an adjuster solution furnished at no charge with the purchase of brightener, a new bath needs no breaking in and plates perfectly with the first load. The use of the new material does not require a bright dip for luster or clearness. However, a chromic acid passivating bright dip is recommended wherever staining due to inadequate rinse occurs.

Compact Laboratory Degreaser

Ramco Equip. Corp., Div. of Randall Mfg. Co., Inc., Dept. MF, 1373 Lafayette Ave., New York 59, N. Y.

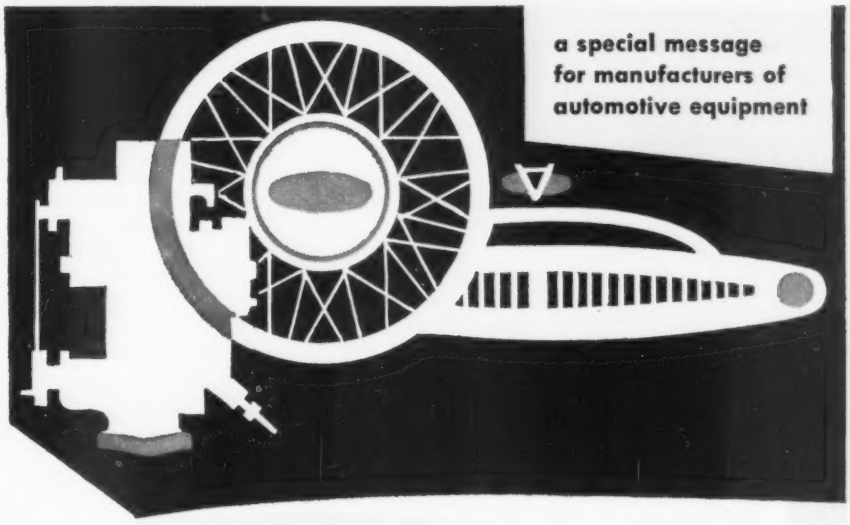
In every respect a duplicate of large standard commercial machines, the new model is a compact-size degreaser for vapor-spray degreasing of precision parts and for laboratory usage.

This Ramco U-18 is constructed of all welded stainless steel, with copper condensation coils and interplumbing. It has a stainless steel immersion heater, with thermostatic liquid heat control. Copper cooling coils maintain positive vapor level with needle valve water inlet control.



An engineered water separator storage tank holds entire contents of main sump. The degreaser has complete solvent recovery system by operating overflow valve, machine automatically distills contaminated solvent and is ready for operation again.

The overall dimensions are 34″ x 15″ x 22½″ high, with a working area of 18″ x 12″ x 12″. Capacity: 100 lbs.



need a finish for low cost corrosion protection or showroom sparkle?

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IRIDITE®

Whether you're finishing non-ferrous parts for high corrosion protection, paint base, or for showroom sales appeal, you can be sure of low material and production costs and peak performance when you specify Iridite. Here's what you can do with Iridite:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

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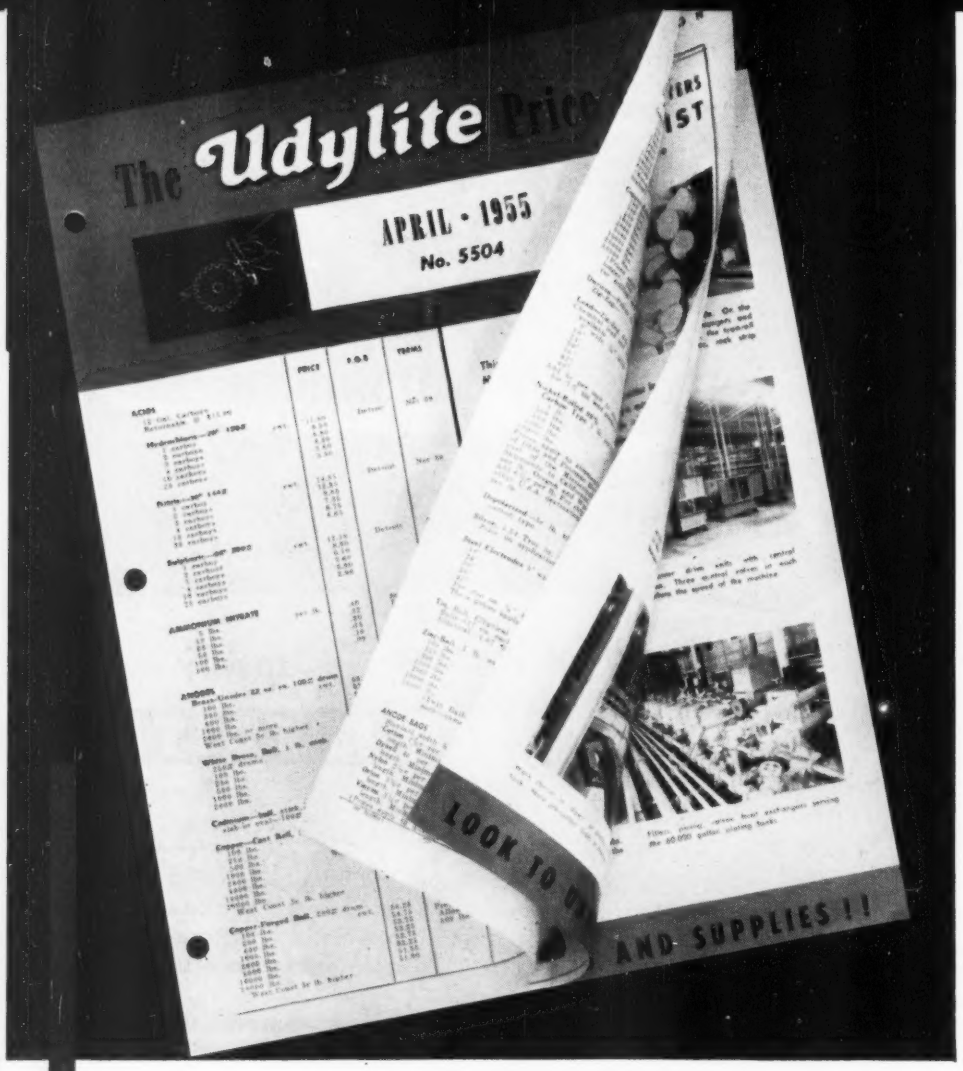
Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals.
WEST COAST LICENSEE: L. H. Butcher Co.



THIS SERVICE WAS DESIGNED FOR YOU

A lot of profits can roll out the back door of your plating shop if you fail to keep up-to-date on prices of the hundreds of items you use every day. That is why Udylite, as another of its many free services to electroplaters, publishes the Price Guide—a monthly price listing of important items regularly used by the trade, as well as information about new developments in equipment and processes.

It pays to buy supplies from Udylite—you can be sure of top quality, accurate weight and pricing—that Udylite stands back of every sale. You can be sure of prompt delivery too, as Udylite has widespread warehousing service.

The Udylite Price Guide has become an important tool for thousands of electroplaters. If you are not receiving your copy now, send us your name and address and it will soon reach your desk on the first of each month.

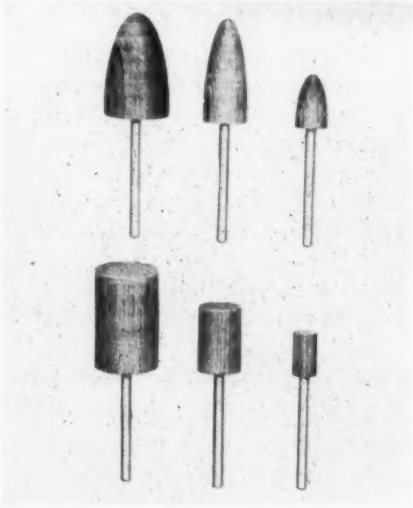
THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

per hour. Heat: 1,600 watts, 110 volts plug-in. Weight, 45 lbs. It is priced at $195 without pump; $265 with pump.

Mandrel Mounted Bobs

Engis Equipment Co., Dept. MF, 431 So. Dearborn St., Chicago 5, Ill.



Conical and cylindrical bobs have been recently introduced, made of Hydulignum, a patented material of exceptional density and toughness formed of highly compressed, laminated hard wood.

As these new bobs are designed primarily for lapping or finishing with diamond compounds, the compressed grain direction is perpendicular to the circumference, which provides a perfectly uniform surface for efficient charging and retention of the diamond particles—a construction that assures long service, and easy reshaping when required.

The cones or cylinders are perfectly centered on 1/8-inch diameter shafts, and exactly balanced to prevent chatter or bounce when used with a flexible shaft rotary tool. These bobs (as well as soft wood bobs) are available in three sizes of each of the two shapes.

Liquid Compound to Keep Steam Cleaners Free of Lime

C-Z Chemical Co., Dept. MF, Beloit, Wis.

A new liquid solvent for use in steam cleaners, Pena-Solv, will keep them free of lime deposits. The lime is held in suspension and thus does not clog the coils. The material is non-toxic, non-irritating and may be used freely in any enclosed area without fear of hazardous effects such as burn-

ing of eyes, throat and skin, it is claimed.

The new solvent offers many other advantages over old type compounds. It completely softens hard water and removes soluble accumulations from all surfaces. It is available in 55, 30, 15 and 5 gallon containers and is diluted with water for use. It is used in any type steam cleaner.

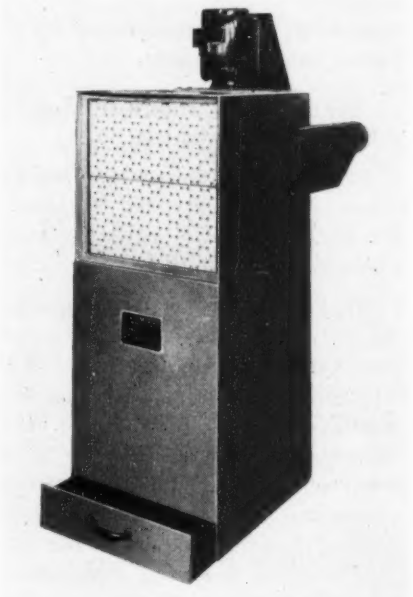
Further information on this product may be obtained by writing to the manufacturer at the above address.

Dust Collector

Schmieg Industries, Inc., Dept. MF, P.O. Box 4701, Detroit 34, Mich.

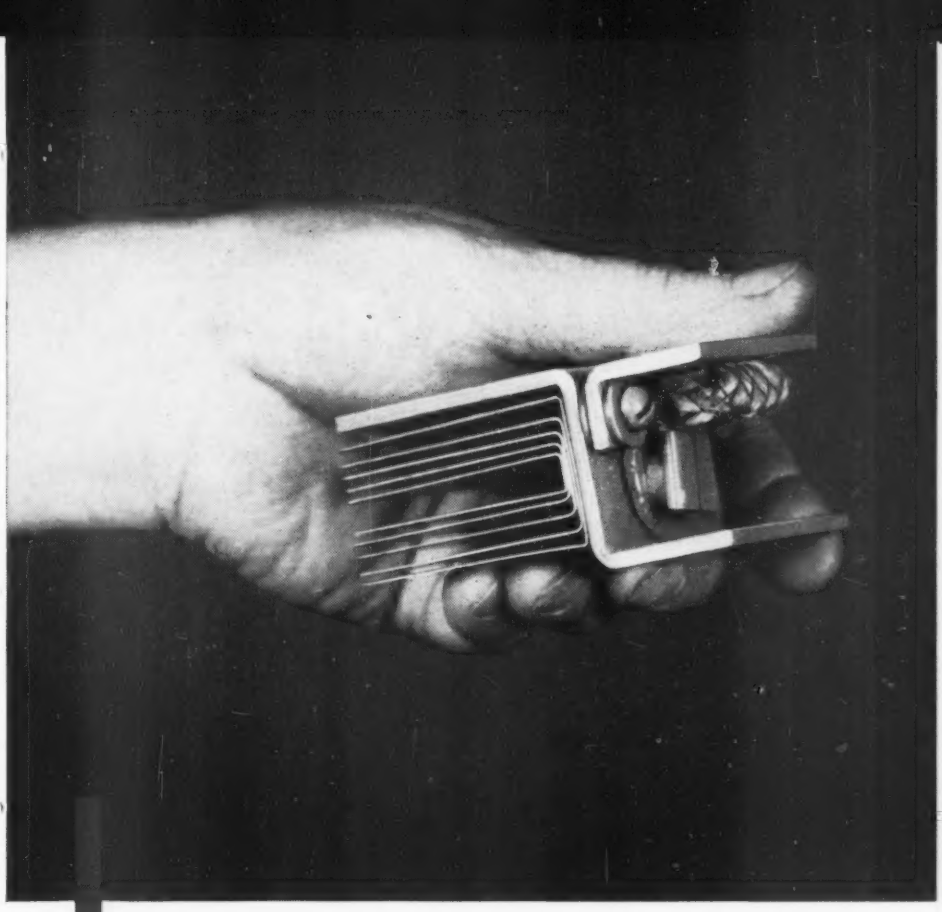
Dust-Pak, a new completely portable package dust collecting system is for use in small installations or on isolated machines in large plants. It is available with casters where flexibility is desired for special operations.

The unit extracts dust and other particles from the air by a combination centrifugal separation and filtration. It has a replaceable standard "throw-away" type filter. The manufacturers point out that the centrifugal action minimizes the dust load transmitted to the filter, adding to the length of its serviceability.



Heavier particles are separated from the air and deposited in a drawer at the base of the unit for quick disposal. The unit is available in sizes from 400 to 1,000 c.f.m.

Further information on this Dust Collector and other models may be obtained by writing directly to the manufacturer at the above address.



GERMANIUM RECTIFIERS PERFORM WITH TOP EFFICIENCY

Udylite Tests Reveal Amazing Current Conversion Efficiency

This air cooled germanium cell with a rectifying surface the size of a dime will handle a 250 ampere load in a three phase circuit continuously and three years of tests show no detectable power losses. Including heat-radiating fins, it takes up just 8 cubic inches of space and weighs only 12 ounces.

Udylite in cooperation with the General Electric Company, now proudly introduces its new group of germanium rectifiers. Years of research and testing have proven that no other metal known offers the high efficiency of germanium as a rectifier material.

In operations calling for medium to high voltages, such as barrel plating, anodizing or chrome plating the efficiency of germanium soon pays the cost since the efficiency of a 3-phase germanium cell is *98* to *99 percent.*

Even at high loading germanium has less than one-volt drop in the forward direction. As for reverse current, germanium is again particularly good, having a reverse-to-forward resistance ratio of 400,000 to 1. Furthermore, Udylite germanium rectifiers require little maintenance and can be located in areas of minimum ventilation.

For further information regarding germanium rectifiers—prices, deliveries and specifications—consult your Udylite representative or write today direct to:

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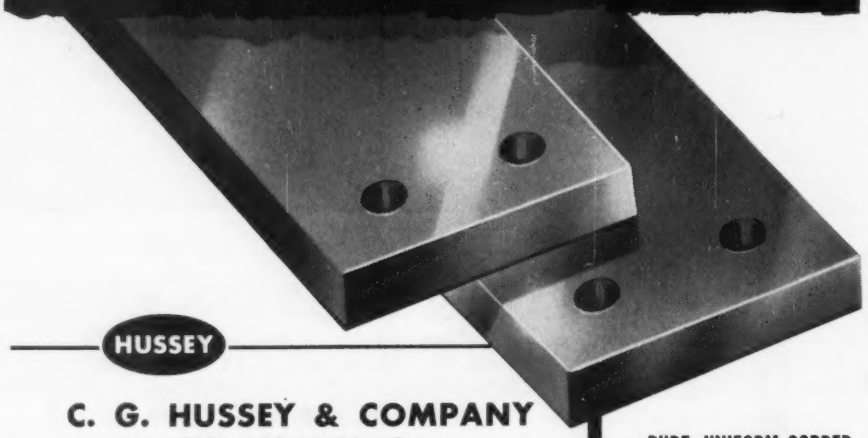

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NEW BOOKS

Chemical Engineering Materials

By Frank Rumford. Published by Chemical Publishing Co., Inc., 212 Fifth Ave., New York 12, N. Y. 1955. Price $7.50. 382 pages including appendixes and index.

With the aim of providing a survey of chemical plant construction, the author first describes the general mechanism of chemical attack, then the essential methods of material testing, following which he takes up, in order, metals, stoneware, wood, plastics and rubber. Protective coatings for metals are covered in a short but concise chapter of sufficient scope considering that such coatings are not generally the most suitable materials for chemical corrosion resistance. The book limits itself to design for corrosion resistance and does not concern itself to any great extent with strength of materials or economics. This would be considered a limitation to the value of the volume since, despite the author's contention, no distinction should be made between design for corrosion purposes and normal engineering practice, in our opinion. However, the numerous references to the literature permit the student to investigate any phase of the subject to greater detail so that the limitations are of minor consequence. We were very favorably impressed with the chapter on acid-brick, tile and stoneware construction, which is of value to any engineer called upon to install a floor or an acid-brick lined tank.

Process Engineering Economics

By Herbert E. Schweyer. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd. St., New York 36, N. Y. 1955. Price $7.50. 369 pages plus appendixes and index.

The increasing emphasis on economics in training engineers prompted the preparation of this reference and textbook. Graduates of an earlier period, including this reviewer, have been in need of a book which explains the practical use of cost data in evaluating the economic feasibility of a chemical process, whether it involves a heat exchanger, a filter, or a still. The author fills this need with a volume which can be employed as a source book of ideas for effecting savings in design and operation. The presentation is in familiar terminology and form, both the theory and the actual practice. Break-even points are treated in complete detail and a large number of examples illustrate specific points in each chapter.

Transactions Institute Metal Finishing

Published by Institute of Metal Finishing, 32 Great Ormond St., London, W. C. 1. 1955. 554 pages, including index. Price: £3.10.0. to non-members.

Volume 31 contains the proceedings of the *Fourth International Conference on Electrodeposition and Metal Finishing*, held in London last year, and is organized into groups of papers on various subjects, such as anodic processes for aluminum, fundamentals, chromium and tin coatings, nickel plating, American electroplating practice, organic finishing, electrodeposition of miscellaneous metals and four papers on the future.

As is to be expected in an international meeting, a number of papers are of a general nature, which do little more than summarize current practice. However, the reputation of the Institute for technical reports and papers of a high degree of excellence is very amply supported by numerous examples in this volume. To list just a

few, a method of electroplating with modulated current, a new method of plating gold alloys, electrodeposition of porous metal, studies of the action of organic compounds at the surface during nickel plating, and a new quantitative adhesion test for chromium plate.

Considering the number of pages in this book, the price is very reasonable. Based on the amount of valuable information available in the 37 papers published, the metal finisher is getting a real bargain.

Principles of Industrial Waste Treatment

By C. Fred Gurnham. Published by John & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1955. 392 pages plus index. Price: $9.50.

Written primarily for the student already acquainted with chemistry and physics, this is not a handbook to refer to for waste treatment data but a text which treats the operations and processes involved from the standpoint of teaching those to whom the subject is new. The "unit process" approach, in which subjects such as filtration, pH adjustment, oxidation and reduction, and other treatments are discussed, not by industry but by specific method, is a very desirable one since it provides the basis for understanding developments in the field.

Because this is a textbook, the practicing engineer will find a number of subjects elementary. However, the large number of technical men in the metal finishing field who are aware of the growing importance of waste treatment and disposal and desire to familiarize themselves with the fundamentals should find the book a valuable addition to their technical libraries.

Engineering Metallurgy

By L. F. Mondolfo & Otto Zmeskal. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd. St., New York 36, N. Y. 1955. Price $7.50. 382 pages plus index.

This is a textbook for those engineers whose primary interest does not lie in the field of metallurgy. Therefore, the basic theory is stressed only as an introduction to the practical applications and, in addition to references, each chapter concludes with a number of problems concerning the subject matter. Through stress on unity of concept, as opposed to compartmentalization of the behavior of individual metals, the authors simplify the problem for the engineer of understanding how and why metals behave as they do. In this connection, a generous number of illustrations is of valuable assistance.

Chemical Engineering

By J. M. Coulson & J. R. Richardson. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd. St., New York 36, N. Y. 1955. Price $7.50. Volume 1, 384 pages including index.

Although many books have been published on special phases of chemical engineering, very little has been written of a general nature. The authors have attempted to present the subject in two volumes of which this, the first, is concerned with the fundamentals of fluid flow, heat transfer, mass transfer, and humidification and water cooling. Since this is the latest work, which also makes it the most up-to-date, engineers may be interested in brushing up on their basic training, especially if they haven't forgotten their mathematics. The book, we must warn, is for the chemical engineer, not for the plater or production man, unless familiar with differtial calculus.

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POLISHING & BUFFING OPERATIONS

in the finishing of

METALS, PLASTICS, & WOOD.

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Aluminum Tube

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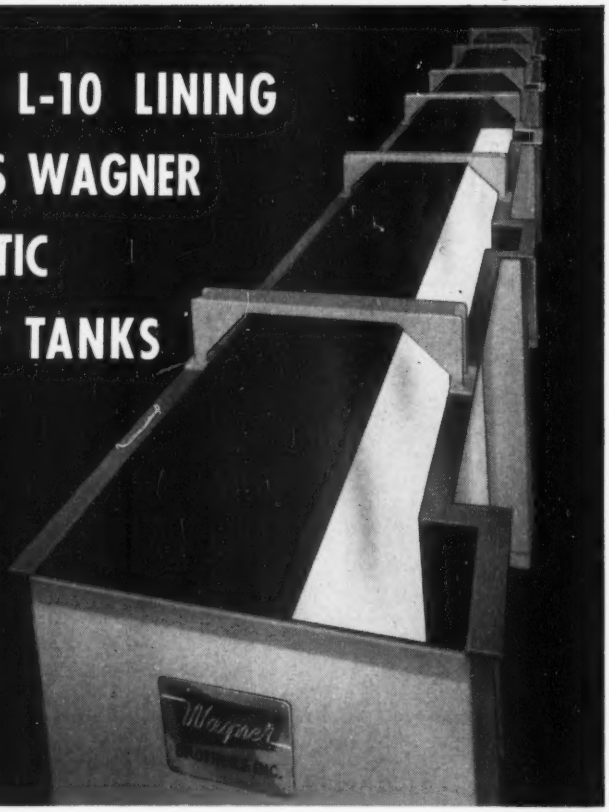
VYFLEX® L-10 LINING PROTECTS WAGNER AUTOMATIC PLATING TANKS



No wonder Wagner Brothers, Inc., Detroit, Michigan, wanted the best possible lining protection for their famed automatic plating machines. Representing a small part of the original cost of each Wagner machine, the linings go a long way toward protecting each customer's total investment. Here's why Wagner, after rigorously testing all available materials, decided to standardize on Kaykor's Vyflex L-10 tank linings:

- *Vyflex L-10 excels in all four important categories of lining performance: corrosion resistance . . . electrical insulation . . . strength, toughness, and elasticity . . . fool-proof application.*
- *The highly polished, exposed surface of Vyflex L-10 assures easier cleaning, better solution flow, less hang-up on tank walls.*
- *Available in black or white,* both *can be used, as in the tank illustrated, to assure superior visibility of tank contents. Vyflex L-10 white has improved color stability, will not turn yellow. Standard thicknesses of 3/32" and 1/16".*

The uses of Vyflex L-10 linings extend far beyond automatic plating tanks . . . including the protection of every type of equipment subject to corrosion. Qualified Kaykor applicators across the United States and Canada give fast, professional service applying Vyflex L-10 to steel, wood, concrete, in the field or in the shop.

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BUSINESS ITEMS

New Plant Superintendent Named by Wagner Bros.

Chester J. Nowak

Chester J. Nowak has been appointed plant superintendent of *Wagner Brothers Equipment Co.*, the manufacturing division of *Wagner Brothers, Inc.*

Nowak was formerly tool and die leader at Expert Tool and Die Co., from 1951-1955.

United Chromium Adds Franchised Applicators of Sprayable Plastisol

Eight additional metal finishing firms have been appointed franchised applicators of Unichrome 5300, a sprayable plastisol made by *United Chromium Division* of *Metal & Thermit Corp.*

The newly appointed applicators are: *Barber-Webb Company*, Los Angeles, Cal.; *Crane Equipment & Supply Co.*, Waterbury, Conn.; *Kaybar, Inc.*, Detroit, Mich.; *Lithcote Corp.*, Norwalk, Conn. and Melrose Park, Ill.; *Metal Cladding, Inc.*, Buffalo, N. Y.; *Metal Weld, Inc.*, Philadelphia, Pa.; *Paterson Rubber Co.*, Paterson, N. J.; and *Rack Processing Co.*, Dayton, O.

Wide experience in applying organic coatings to metals, rigid control standards, adequate application and baking facilities and a reputation for high quality work are requisites for qualification as an applicator.

John Hawley Assigned to Pennsalt Technical Service Staff

John E. Hawley has been transferred to the Technical Service Department of the *Pennsylvania Salt Mfg. Co.'s* Chemical Specialties Division. A research chemist at Pennsalt's Whitemarsh Research & Development Laboratories for the past three years, he will serve as a technical service engineer for metal processing and maintenance chemicals. His work at the laboratories concentrated on the latter field.

Mr. Hawley holds bachelor and master of science degrees in bacteriology from the University of Connecticut. Before joining the company he was employed as a biochemist by the Baltimore & Ohio Railroad in Baltimore.

Richard C. Campbell Joins Metal & Thermit

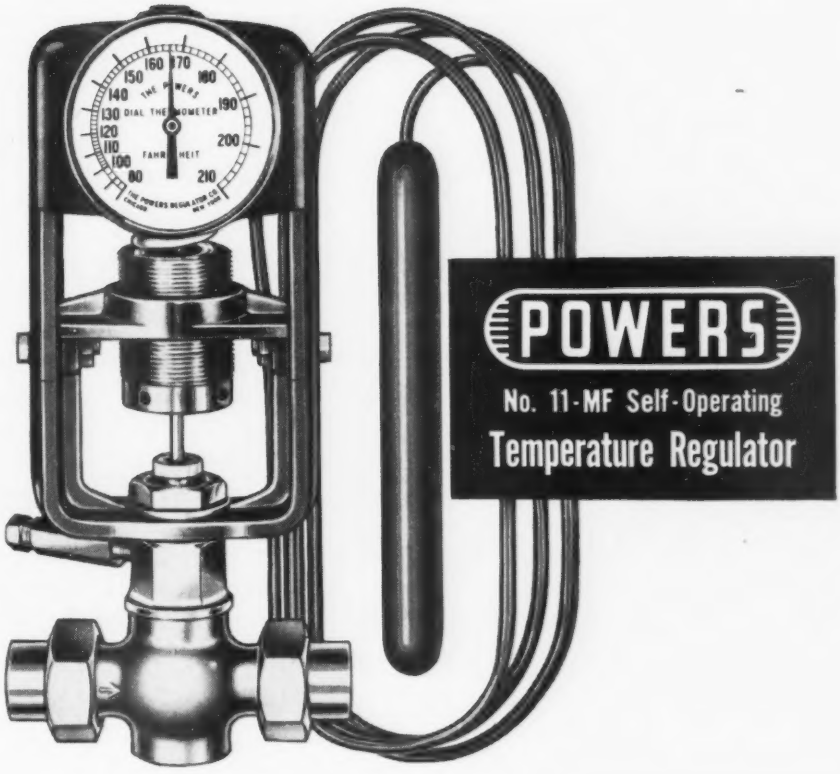
Richard C. Campbell has joined *Metal & Thermit Corp.*, New York, producers of metals and industrial chemicals as metallurgical sales engineer. In his new post he will be assistant to *C. R. Schroder*, manager of the company's Metals Sales Department.

Mr. Campbell was previously connected with the Watson-Flagg Machine Co., Paterson, N. J., as sales and metallurgical engineer.

A graduate of Newark College of Engineering in 1949, Mr. Campbell is presently working on his M.A. in Metallurgy at Stevens Institute of Technology.

He served as a naval aviator in the Pacific Theater from 1942 to 1945, during World War II, and was recalled to active duty from 1951 to 1953.

Richard C. Campbell

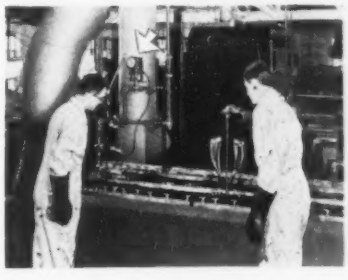


Simplest Way to Control Temperatures Accurately in Plating, Cleaning and Rinse Tanks

Lowers Costs — Betters Quality Control — Repays Its Cost 3 to 6 Times a Year. You eliminate "the human element" in temperature control with Powers Automatic Regulators. Simple, compact and dependable, they stop OVER-heating. Thus, *automatically*, you save on burnt plated parts, rejected anodizing, decomposition of costly additives, and loss of volatile ingredients from some cleaning solutions. You save, too, by preventing "boil-overs." No waste of steam and water by evaporation.

Why Powers No. 11-MF Regulator Gives Better Control and Lasts Longer. Better TEMPERATURE control results from powerful bellows and minimum valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding.

Double ply metal used in Powers bellows outlasts single ply type. Greater durability of plastic covered bulb and tubing also helps prolong the life of the regulator.



Easy to Install — No Insulators Required. Installation of the Powers No. 11-MF goes quickly with no troublesome insulation problems. The unit is completely self-insulated.

Large Dial Thermometer Gives Visual Check. Instant visual temperature check of solutions under control is obtained from the large dial thermometer, makes it easy to adjust regulator for different temperatures.

Powers Nationwide Service and 24 Hour Delivery in the U.S.A. are important time and money saving advantages. Order a Powers No. 11-MF Regulator now. Call your supply firm or write us direct for Bulletin 330 and prices.

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Over 60 years of Automatic Temperature and Humidity Control

COPPER-TIN
Bronze Plating
A NEW DECORATIVE FINISH
A tin-bearing bronze for new, bright, decorative finishes of proven sales appeal when used for wire products, handbag frames, costume jewelry, etc.
Simplifies and speeds PRODUCTION
M & T bronze can be controlled as readily as single metallic salt baths—has excellent throwing power plus a wide bright plate range that minimizes burning and missing...plating speed is up to 50% faster than with other bright baths. Make-up and replenishment costs are low.
Proven ECONOMICAL
A well-known metal finishing company had this experience:
They previously plated with a brass bath for over 35 min., and performed 2 costly buffing operations. When they switched to M & T bright plate, they cut plating time to just 8 min., eliminated buffing entirely!
For further information, write
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CORPORATION
Chemical & Metals Department
100 EAST 42ND STREET • NEW YORK 17, N. Y.

Frank C. Hartwig

most recently was employed by Promat Div. of Poor & Co. in the electroplating and research department and as a technical sales and service engineer. Frank is a member of the Indiana Branch A.E.S. and secretary for the Tri-State Region, A.E.S.

Both men have completed their indoctrination course at the company's laboratory and are located in their respective territories.

Ralph E. Pettit Joins Diversey Corporation

Ralph E. Pettit, former vice-president and works manager of the Chicago Thrift Etching Corp., has been named technical advisor in the metal industries department of *The Diversey Corp.* of Chicago. Mr. Pettit is also well known throughout the metal working industry as first vice-president of the Chicago branch of the *American Electroplaters' Society*.

A University of Chicago alumnus, Mr. Pettit joined the Aluminum Co. of America in 1928. During the next 19 years he was instrumental in the development and sales promotion of the now famous Alumilite process.

Leaving Alcoa in 1947, Mr. Pettit was named general manager of Chicago Thrift, manufacturers of etched metal goods. His responsibility extended to the labor, production and quality control fields.

In 1951, Chicago Thrift Co. was merged with the Etching Co. of America to become known as the Chicago Thrift Etching Corp. At that time Mr. Pettit was named vice-president of the combined corporation.

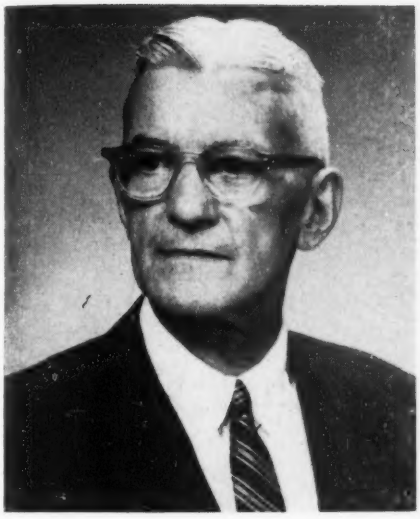
MacDermid Adds Two Representatives

MacDermid Inc. of Waterbury, Conn. recently announced the appointment of two additional sales representatives.

Robert J. Yackley, a 1950 chemical graduate of De Paul University, will work with *E. F. Stack*, Chicago manager, in the Northern Illinois, Wisconsin, Iowa, and Minnesota territories.

Frank C. Hartwig will be located in the Indiana territory with headquarters in Indianapolis. Mr. Hartwig had previous metal finishing experience in the hot-dip galvanizing and pickling department of U. S. Steel Corp., and

Robert J. Yackley



Ralph E. Pettit

In his new position with Diversey, Mr. Pettit will work closely with the field sales force in solving difficult problems in the selection and application of processing chemicals in the metal industry.

New Officers of The Electric Products Co.

The board of directors of *The Electric Products Co.*, a leading Cleveland manufacturer of motors and generators since 1909, announces the elevation of *Dr. W. A. Thomas* to vice-president in charge of engineering, of *J. R. Williams* to vice-president in charge of manufacturing, of *R. J. Berry* to secretary-treasurer and of *R. A. Morey* to assistant secretary and assistant treasurer.

H-VW-M Appoints Roney as Administrative Assistant

Hanson - Van Winkle - Munning Co., Matawan, N. J., announces the addition of *David M. Roney, Jr.*, to their sales organization as administrative assistant.

Roney was graduated from the United States Naval Academy with a bachelor of science degree. Following graduation, he served with the U. S. Navy for nearly five years. Upon leaving the service, he attended the University of Pennsylvania Law School for one year prior to joining the Scintilla Division of Bendix Aviation Corp. With Bendix for nearly two years, Roney was a sales engineer in New York State and Michigan.

In 1951 Roney joined Westinghouse Electric Corp. at East Pittsburgh, Pa., where he became application engineering manager in the Electroplating Projects Department. In his new post, he will be concerned with all phases of sales management.

The world's most economical gold plate...

Sel-Rex Bright Gold Process

The new "GOLD STANDARD"

SAVES YOU MONEY 5 WAYS

1 . . . produces a mirror-bright finish directly from the bath regardless of thickness requirements—eliminates costly, wasteful scratch brushing and buffing.

2 . . . assures a uniform thickness even on edges, in crevices and "blind holes"—has far greater "throwing power" than any other gold plating process.

3 . . . gives 40% more resistance to wear and abrasion—has twice the hardness of conventional 24 karat gold plate.

4 . . . gives six times greater protection with ¼ the amount of gold . . . because it produces denser deposits than any other process — proved in salt spray tests under standard ASTM conditions.

5 . . . costly rejects due to altered or deformed contours (common in conventional gold plating) reduced to the barest minimum — has a unique physical property which assures consistently smooth, uniform deposits.

The new SEL-REX BRIGHT GOLD solution operates at room temperature and is simple and easy to maintain. No special equipment required.

Hundreds of successfully operating installations, both decorative and industrial, prove that SEL-REX BRIGHT GOLD has rendered all other 24 KT. gold plate obsolete.

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BRIGHT RHODIUM PLATING PROCESS

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Newark Detroit Los Angeles

David M. Roney, Jr.

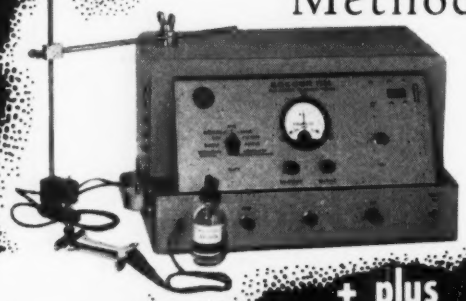
Metal & Thermit Appoints Three Chemical Engineers

Metal & Thermit Corp., producer of metals and industrial chemicals has announced the appointment of three chemical engineers.

Leonard L. Adler has joined the firm as senior development engineer at the company's East Chicago, Indiana plant. He is a native of Cleveland, Ohio. He received a degree as Bachelor of Science in Chemistry from Case School of Technology, Cleveland,

Check plating thickness
WITH THE
KOCOUR ELECTRONIC THICKNESS TESTER*

*Anodic Solution Method



6 Simple steps . . . to quick, accurate results

1.
MOUNT THE CELL . . . on the spot to be tested and clip lead wire to specimen.

2.
ADD TEST SOLUTION . . . which corresponds to the type of plating and base metal tested.

3.
PLACE STIRRER IN POSITION.

4.
SET SELECTOR SWITCH to the type of plating to be tested as indicated on panel.

5.
PRESS THE TEST BUTTON to start the test . . . and upon completion the unit shuts off automatically.

6.
TAKE THE READING directly from the counter on panel i.e., 0.00041".

TOTAL TIME . . . *less than* 2 minutes

+ plus these features

- **DETERMINE THICKNESS OF**
  decorative chromium
  heavy chromium
  silver — copper
  tin — brass
  cadmium — nickel
  zinc — lead
  lead-tin alloy
  tin zinc alloy
  on various base metals and materials.
- **WIDE THICKNESS RANGE**
- **DIRECT READINGS**
- **90-95% ACCURACY**
- **TESTS ARE RAPID**
- **VIRTUALLY AUTOMATIC**
- **ELIMINATES HUMAN ELEMENT**

Don't delay! See how the Electronic Thickness Tester can solve your problem. Write for literature today.

KOCOUR CO.
Pioneers in Control for the Plating Industry

4802 S. ST. LOUIS AVENUE
CHICAGO 32, ILL.

Alvin S. Pollock

in 1948, and comes to the company from Olin Mathieson Chem. Corp.

Richard W. Davis will be located at the research laboratory, Rahway, N. J., as chief development engineer. He was born in St. Louis, Mo., and was graduated from the University of Michigan in 1943 as Bachelor of Science in Chemical Engineering. He was previously connected with General Aniline and Film Co.

Alvin S. Pollock joins the company as process engineer at Carteret, N. J. He attended Carnegie Institute of Technology and Renssalear Polytechnic Institute, graduating from the latter as chemical engineer in 1945. He also received a master's degree in Chemical Engineering from Columbia University in 1947. Mr. Pollock was formerly with Colgate-Palmolive-Peet and Allied Chemical & Dye Corp.

Heatbath Appoints Drinkwater

John Drinkwater has been appointed sales representative for the Michigan territory by *Heatbath Corp.*, Springfield 1, Mass. Mr. Drinkwater will handle the sales and service of their complete line of heat treating and metal finishing products in that area.

Mr. Drinkwater is a graduate of Loyola College and has been associated with *Frederic B. Stevens, Inc.* for the past five years.

Deming Co. Appoints Pritchard

John W. Pritchard has been appointed as mid-western sales representative of *The Deming Co.*, Salem, Ohio. He will call on distributors and dealers in southern Illinois, western Indiana and central Missouri and work

Leonard L. Adler

Richard W. Davis

John W. Pritchard

on specific pump applications for industry. He was formerly a member of the sales department in the home office.

Pritchard is a graduate of Waynesburg College in Pennsylvania. He was an instructor at the Ordnance School, Aberdeen Proving Grounds, Md.

General Ceramics Announces New Relining Service for Users of Glass-Lined Equipment

The *General Ceramics Corp.* of Keasbey, N. J. announces a new fast service for the relining of glass-lined chemical equipment.

Glass-lined tanks, kettles, reactors, valves and all other types of chemical equipment can now be relined quickly and economically. The development of an unsurpassed acid and alkali resistant enamel by *Keasbey Corp.*, a General Ceramics affiliate, makes it possible to give quick, efficient service.

Acheson Colloids Announces New Appointments

M. W. Reynolds, vice-president and general manager of *Acheson Colloids Co.*, Port Huron, Mich., announces the appointment of *John W. Shier* as assistant general manager of the company. Mr. Shier was the company's production manager, and *Bart C. Dickey*, formerly process development engineer, has been promoted to fill this position.

Shier, who joined the firm as a plant engineer in 1949, has served this past year as chairman of the Detroit Section of the American Institute of Chemical Engineers, and is a member of the Institute's National Committee on Professional Guidance. He is also

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Roto-Finish processes are controlled precision finishing operations using low cost mass production techniques, which maintain exact tolerances on most any size or shape precision part with no significant dimensional changes. Roto-Finish speeds production, cuts maintenance expense, minimizes operational costs, yet produces top quality finishing results. Roto-Finish offers latest in controlled methods, materials and special purpose fixture equipment. Roto-Finish is your new opportunity in controlled precision finishing with guaranteed results!
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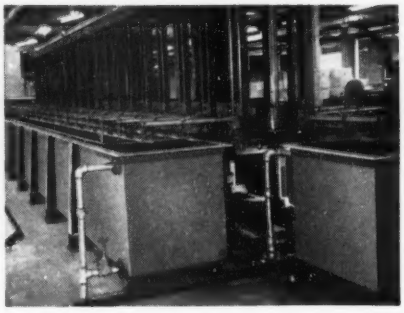
John W. Shier

Bart C. Dickey

HOW TO BUY RUBBER LINING

FOR LONG LASTING PROTECTION OF EQUIPMENT AND PROCESSES



For pickling and metal plating you need positive protection against corrosive effect of acids on your equipment . . . and the contamination of solutions used in your operations. Linings of thick, non-porous layers of rubber, rather than a mere film or coating, offer the kind of lasting protection that lengthens the service life of your tanks and other process equipment. Rubber tank linings should be compounded to withstand changes in temperature and present a resilient, non-breakable surface at all times.

Look for rubber linings that provide an inseparable bond of rubber to metal. Where linings are bonded to metal so securely they *can't* separate, you are assured permanent protection from corrosion and contamination as well as stray plating currents.

Entrust your equipment to the company with facilities to efficiently handle any equipment lining job, regardless of size or complexity . . . and the reputation of years of leadership in rubber lining technique . . . specify "Manhattan Rubber."

MANHATTAN RUBBER LININGS

Whether your lining problem is simple or complex, Manhattan Rubber Linings assure you lasting protection against deterioration of equipment and contamination of the solutions used in your operations. Manhattan Rubber Linings are made from thick, calendered sheets of natural or synthetic rubber . . . compounded to expand and contract with the metal without cracking and eliminate stray plating currents. Tests prove they cannot be separated from the metal without breaking. To make certain your equipment has perfect bonded protection, every Manhattan Lined Tank is tested under high voltage to detect any possible imperfections. Let an R/M lining engineer show you why Manhattan Rubber Linings are the best you can get . . . contact the R/M rubber lining facilities nearest your plant. RM 524

RUBBER LINING PLANTS AT PASSAIC, N. J.—NORTH CHARLESTON, S. C.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose
Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles
Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

active in the Engineering Society of Detroit. Before coming with Acheson, Mr. Shier was employed as a chemical engineer by the Heyden Chemical Co. in Detroit. He attended the University of Michigan and was graduated as a Chemical Engineer from Wayne University.

Mr. Dickey was graduated with a B.S. in Mechanical Engineering from Wayne University in 1947. He had been previously employed by the Beloit Iron Works and the Port Huron Sulphite & Paper Company. He is a member of Tau Beta Pi and Pi Tau Sigma.

Infilco Appoints Walters

Infilco, Inc., manufacturer of water and waste treating and filtering equipment, announces the appointment of *John G. Walters* to the position of sales representative for Georgia, North Carolina and South Carolina.

Mr. Walters, born in Massey, Md. thirty years ago, has a Bachelor of Science degree in chemistry and biology from Washington College, Chestertown, Md., and a Master of Arts degree from Teachers College of Columbia University. He took pre-med courses at Temple University School of Medicine and studied a year at Johns Hopkins University, Dept. of Sanitary Engineering, Baltimore, Md.

After two years in the Army Mr. Walters became the first field representative for the Maryland Water Pollution Control Commission and conducted a vigorous pollution abatement

John G. Walters

program for the state from July 1947 to February 1951. From this time until joining the company in 1953 he served industry as a consultant on waste disposal.

Mr. Walters is a member of the Virginia Industrial Wastes and Sewage Works Association and the Maryland and Delaware Water and Sewage Association.

Nankervis Buys Commercial Research Laboratories

The *George L. Nankervis Co.* of Detroit, manufacturers of laboratory and production testing equipment for the automotive and aircraft industries, has announced it had completed negotiations to purchase the entire assets of the *Commercial Research Laboratories, Inc.*, also of Detroit, builders of Cox instruments, flowmeters and related scientific equipment. Terms of the sale were not disclosed.

Name of the new company will be Commercial Research Div., George L. Nankervis Co. It will continue to operate with its own personnel under the direction of *Claude E. Cox*, founder and president. Cox, a pioneer in the development of scientific equipment for the measurement of pressure, flow, and vibration, has headed the company since its establishment in 1912.

Acquisition of Commercial Research Laboratories marks the seventh expansion of the Nankervis Company in the past five years.

G.-E. Rectifier Department to Build New Plant

A *General Electric Co.* plant costing in excess of $5,000,000 will be built at Lynchburg, Va., as the new home for the company's Rectifier De-

partment, now located at Lynn, Mass., and at Limerick, Me.

Grading of the plant site will begin in November, and actual construction of the plant will start in March, 1956. Initial production is scheduled for January, 1957. The plant will eventually employ about 800 persons, more than 600 of whom will be hired from the local area.

The plant will occupy a 100-acre site located about 2 miles southeast of the Lynchburg city limits, adjacent to the main line of the Southern Railroad. It will consist of a one-story manufacturing building and an adjoining two-story office structure which, together, will provide in excess of 200,000 square feet of floor space. Approximately 13,500 square feet will be devoted to modern laboratory and research facilities. The plant-site will provide adequate parking space for employees and is sufficient to permit expansion of the plant as its business requires.

American Buff Celebrates 20th Anniversary

Celebrating the twentieth anniversary of the founding of *American Buff Co.*, Chicago, president *Ben P. Sax* distributes bags of twenty silver dollars to Chicago plant employees.

In photo, left to right: *Sylvester Mockiewicz*, *Leonard Sax*, *Willie Swope*, *Bill Chill* and *Ben P. Sax*. Employees shown in photo boast length of service records in excess of fifteen years with the company.

Detroit Harvester Buys Peters-Dalton Co.

Purchase of the *Peters-Dalton Co.*, of Detroit, one of the largest producers of spray booths, washers and ovens for the automotive and other metals industries, by the *Detroit Harvester Co.* was announced by J. Thomas Smith, Harvester president, on October 1.

Retaining its name and personnel intact, the firm, located at Ryan and Nevada, in Detroit, and doing a $10,000,000 annual business, became a wholly-owned Detroit Harvester subsidiary with consummation of the purchase.

The acquisition of Peters-Dalton, for an undisclosed sum, in cash and Detroit Harvester common stock, in payment to the firm's shareholders for their stock, was part of the long-range expansion and diversification program of Detroit Harvester, one of the country's largest producers of automotive parts and equipment, power lawn mowers and farm mowers.

Stauffer to Supply Degreasing Solvents

Stauffer Chemical Co. has become a supplier to the degreasing industry, manufacturing a specially stabilized perchlorethylene. In addition, the company can supply methylene chloride for liquid, cold phase degreasing and carbon tetrachloride.

Perchlorethylene is manufactured at the company's large petro-chemical plant at Louisville, Ky. Here hydrocarbon gases are chlorinated and treated to produce perchlorethylene, carbon tetrachloride, and anhydrous hydrogen chloride by a process which utilizes several new and unique features developed by company engineers.

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36 page illustrated cleaning methods manual

In these pages you'll find the answer to the proper method, the proper machine and the proper material for any cleaning operation. This manual analyzes basic cleaning techniques and provides a particular answer to your individual cleaning requirements, and covers such subjects as "Dip versus Spray", "The Importance of Mechanical Agitation in Cleaning," "Spray Dip Equipment" and many others.

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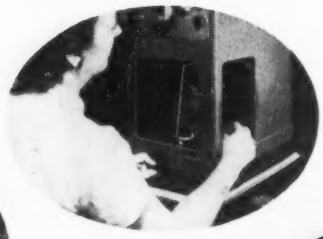
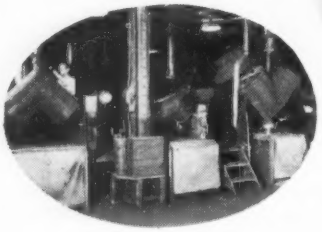
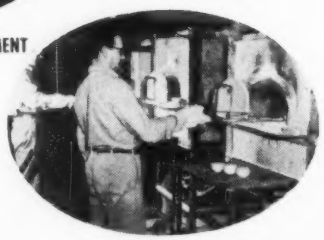
LONG EXPERIENCE
(HANDY & HARMAN
FOUNDED 1867)



SUPER-ACCURATE EQUIPMENT



SCIENTIFIC METHODS

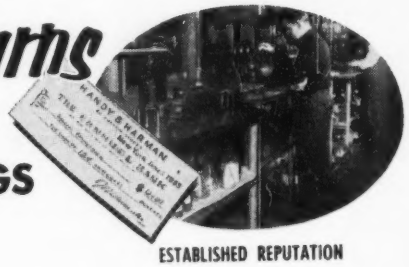


SKILLED PERSONNEL

when all is said and done...

accurate returns

are what you want
from your REFININGS



ESTABLISHED REPUTATION

Yes sir—when it comes to your REFININGS, the one thing you're interested in is this — that from every lot you send out, you get an *accurate* return for *every bit of precious metal value* it contains.

But don't forget this — before an *accurate* return can be made, your Refiner must be able to *extract* from each lot *every last fraction of value it contains*. This calls for a tried and proved scientific method for treating each different form of solid and liquid waste containing precious metals... plus highly accurate modern equipment... plus highly trained and experienced shop and laboratory personnel... and last but not least — an established reputation for giving consistently accurate returns.

You are *sure* of all these things when you send your refinings to Handy & Harman — leading fabricator and refiner of precious metals from coast to coast. TRY us with your next lot — ship it to our nearest plant — let the returns speak for themselves.

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FOUNDED 1867 QUALITY SERVICE

HANDY & HARMAN

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New York 38, N. Y.

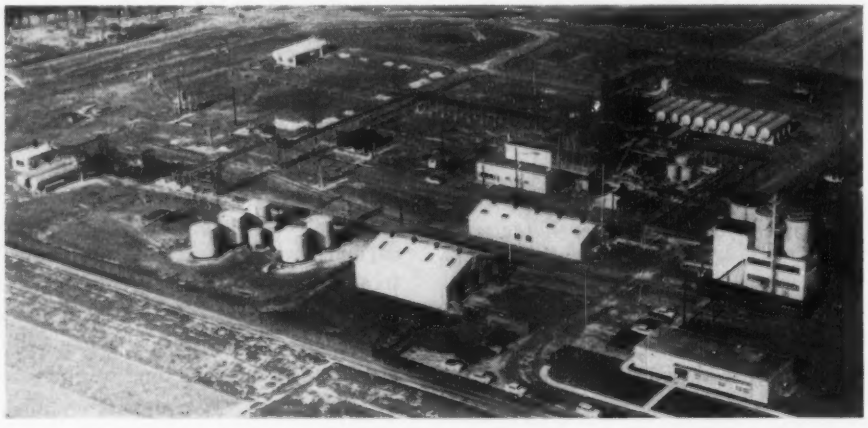
15 West 46th St.
New York 36, N. Y.

Bridgeport 1
Conn.

425 Richmond St.
Providence 3, R. I.

The anhydrous hydrogen chloride is sold to industrial manufacturers in the area. The carbon tetrachloride and perchlorethylene are shipped in tank cars and 55-gallon drums distinctively striped for quick identification in customers' plants. Stocks are maintained in the East, Midwest and Pacific Coast areas.

The plant at Louisville represents an investment of over $5,000,000. The company's long experience in the manufacture and formulation of chlorinated hydrocarbons, its modern well located production facilities, and its familiarity with the market through the sale of mineral acids and caustic soda, were the determining factors in Stauffer's decision to enter the metal finishing field with its perchlorethylene formulation.



"Mini-Tumbler" is Winning Name for New Rampe Bench Tumbling Machine

Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland, Ohio, conducted a contest from their Booth at the Metal Finishing Show, during the A.E.S. Convention last June, to get a name for their new, small bench tumbling machine.

From the many names submitted "Mini-Tumbler" was selected as the most descriptive. This name was suggested by *A. D. Schwegler, Jr.*, Research Supervisor for The Cleveland Twist Drill Co., Cleveland, Ohio. The prize was one of the units.

(The photo shows Mr. Schwegler with his prize.)

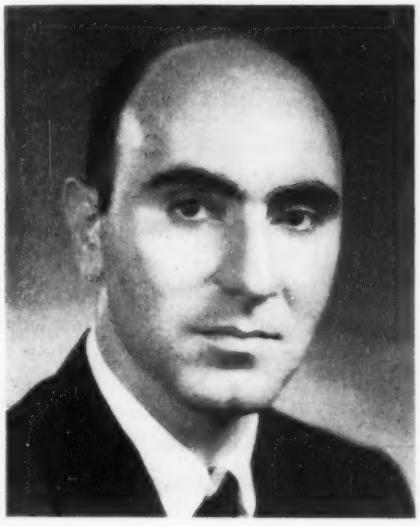
Bart-Messing Names Corigliano Advertising Manager

Appointment of *G. S. Corigliano* as advertising and sales-promotion manager of *Bart-Messing Corp.*, Belleville, N. J., manufacturers of equipment for the metal finishing industry, has been announced by *Morris M. Messing*, president.

An alumnus of Columbia University,

Mr. Corigliano has specialized in industrial advertising and promotion for the past decade in affiliations with manufacturers of graphic arts machinery, industrial electrical appliances and food processing equipment in metropolitan New York and New Jersey.

In his new position, Mr. Corigliano will also initiate and direct advertising and promotion for *Sel-Rex Precious Metals, Inc.*, developers of precious metals plating processes; *Bart Manufacturing Corp.*, producers of anti-corrosive nickel plated steel sheets,



G. S. Corigliano

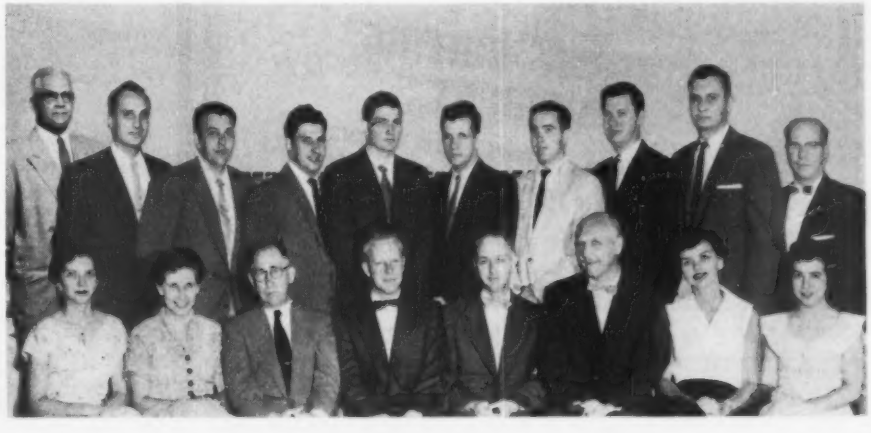
pipes and fittings; and *Bart Laboratories Co., Inc.*, pioneers in the electroforming process of manufacturing; all of which companies are under common owner-management.

Wyandotte Chemicals Opens Enlarged Technical Service Laboratories

Enlarged technical service laboratories were recently opened by the *J. B. Ford Division* of *Wyandotte Chemicals Corp.*, both in Wyandotte, Mich. and in Los Nietos, Cal., near Los Angeles. These enlarged headquarters facilities enable the firm's more than 200 resident representatives to give faster trouble-shooting service.

Shown left to right in the photo are, seated: *Beatrice Rike*, secretary to Mr. Anderson; *Vera Heins*, secretary to Product Control Center; *Lee Minor*, field service representative; *Donald E. Anderson*, director technical service; *Gail Smith* and *Armin Roth*, field service representatives: *Beverly Compeau* and *Rosalie Giaimo*.

Standing: *Al Weimar*, resident representative in Chicago; *Edward Kubis*, industrial field service representative; *Howard Anderson, Theodore Poloway, Jack Bowen, Leo Hawk, Tom Gilman* and *Victor Boka* of the Wyandotte, Mich. laboratories; *Richard Booth* and *Fred Vassar*, resident West Coast representatives.



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more than **60%** of your

ELECTROPLATING GOLD

In our work with Electroplaters we generally find that they are reconciled to wastage — until they learn they may be losing $60,000 or more of every $100,000 paid for gold. Exorbitant waste is often due to outmoded equipment and inefficient electroplating methods and solutions. We correct these conditions so effectively that your cost can drop to a record low figure — while you increase efficiency and achieve predetermined standards of deposition that can be repeated indefinitely.

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Our Engineering Service is available, without obligation . . . and every proposal we make is backed by solid experience with problems like yours.

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McCarthy New District Sales Supervisor for Armour

John M. McCarthy

John M. McCarthy has been appointed district sales supervisor of the coated abrasives division of *Armour and Co., R. L. Reeves,* division general manager, announced. Mr. McCarthy's territory covers the central Chicago metropolitan area.

Mr. McCarthy has been with the firm since 1945, starting in the Chicago plant and later transferring to the industrial relations department in the general office.

Eaton Stamping Division Resumes Production Following Big Moving Project

Production was resumed Monday, Aug. 15, by the Stamping Division of the *Eaton Manufacturing Co.* in its new and completely modernized plant, at 17877 St. Clair Ave., N.E., Cleveland, designed to meet the increased demand by the automotive industry for the division's specialized stamped and plated products.

Resumption of stamping and plating followed a shutdown for one of Cleveland's biggest moving projects—the transfer of the entire division's operations 38 city blocks from the former site at 755 E. 140 St., adjacent to the Eaton Axle Division plant. When full production is achieved in the new building, the division's capacity will be increased by approximately 40 per cent, according to *E. M. deWindt,* Stamping Division general manager.

The remodeling and moving project cost more than $3,000,000 and included installation of the most modern stamping, plating, automatic polishing, welding and tooling devices.

Major among the new equipment installations were a million-dollar automatic nickel and chromium plating machine, with a 52,000-gallon nickel solution capacity, for plating bumper guards, hub caps, grilles and other automotive hardware produced in the Stamping Division, and 10 presses of the 100-to-300-ton class. Also included were installation of modern shipping and steel-receiving docks, cranes and other handling devices.

Alterations to the new building included increasing the manufacturing floor space by 25,000 square feet, to a total of 150,000, with adaptation of an additional 33,000 square feet for office space. The new location also is more readily accessible for shipping and receiving, and has expanded employee and visitor parking facilities.

Lord Chemical Adds to Plant

Lord Chemical Corp. has just completed a new 6,000 sq. ft. addition to its plant at 2068 S. Queen St., York, Pa. This is the fourth successive addi-

★ BUFFING NU SPRA GLU
Liquid buffing compound
since 1945

★ NUGLU
Cold flexible glue
since 1937

★ BRUSHING NUGLU
Grain and Nuglu mixture
since 1941

★ SPRAY BUFFING EQUIPMENT
Guns, pumps, and valves
since 1945

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For the Finest in PLATING RECTIFIERS

A BETTER SOURCE OF DC POWER — MORE FOR YOUR MONEY

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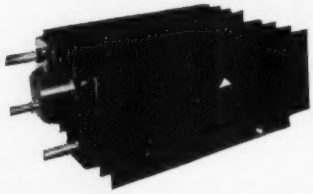
★ Heavy Duty Transformers, Husky Fans

Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.



Replacement Rectifier Stacks for Lektron or Udylite-Mallory

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs.

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

SOME JOBBERS AND SALES TERRITORIES OPEN

ELECTRONIC RECTIFIERS, INC.
2102 SPANN AVENUE INDIANAPOLIS 3, INDIANA

tion to be made to the plant during the past 2½ years. The new two-story wing will be used for the storage of Lorco tumbling compounds, aluminum-oxide chips and "P.S." plastic starch cream.

U. S. Firm Sets Up First Full-Time European School

The *Minneapolis-Honeywell Regulator Co.* announced recently plans for the establishment in England of a technical training school to groom engineers and other technical personnel in the use of automatic control equipment used broadly in the United States. Classes for the first year will comprise M-H personnel from Great Britain, Holland, Switzerland, Sweden, Belgium and Germany. Later plans call for customer "students" from Great Britain and western European industrial firms to attend the school. This is believed to be the first full-time training school set up abroad by an American manufacturer.

The industrial control devices to be studied at the school cover a wide variety of automatic recording, measuring and controlling instruments which are typical of the automation pattern that is growing rapidly in the U. S.

The new training school, to be established in Perivale (about seven miles outside of London) will be a one-level building with fully equipped classrooms and laboratories. Tuition will be free (although customer "students" will be expected to bear their own maintenance expenses) and the courses will run about 10 weeks. In some cases they will extend to 14 weeks, or as long as an ordinary college quarter. Final exams and a diploma will follow.

Director of the school will be *Harry Horton*, a member of the firm's subsidiary in Great Britain, Honeywell-Brown Ltd. Mr. Horton, whose background is primarily in sales and service, is a graduate electrical engineer. He is a member of the Institute of Electrical Engineers and the Society of Instrument Technology in Great Britain.

Hubbell Metals Opens Plant in Memphis

Howard Broemmelsick

Hubbell Metals Inc., St. Louis, one of the largest distributors of metals in the Mid-West, has announced the opening of a plant in Memphis, Tenn. The plant, at 484 S. Front St., will serve the Memphis industrial area with complete stocks of steel, brass, copper, aluminum, stainless steel, fasteners,

Long or short - -

Plan all your tanks for long life – the STORTS way

Plan to use a construction material that will check corrosion. Specify Stortswelding, to be sure of sound, strong, dependable welds. Rely upon Storts experienced craftsmen for installation of all details — partitions, coils, fittings, etc.

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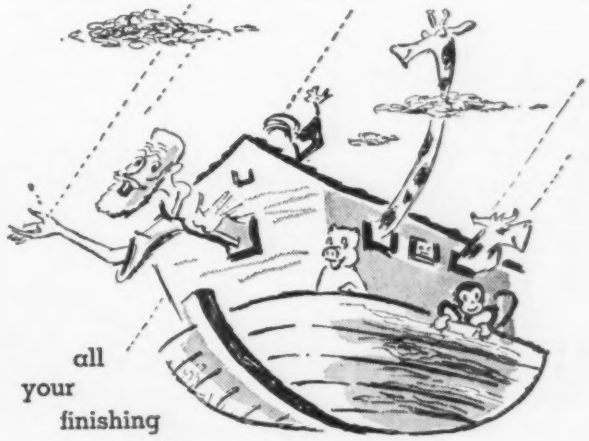
Manufacturers of Welded Fabrications to Specification



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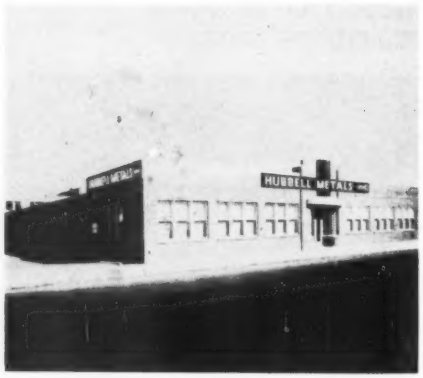


fittings, valves and accessories, and will provide shearing and cutting service.

The firm also maintains plants in St. Louis, Kansas City and Indianapolis. Companies whose products they distribute include United States Steel Corp., Kaiser Aluminum and Chemical Corp., The Dow Chemical Co., Revere Copper and Brass, Inc., Laclede Steel Co., Imperial Brass Mfg. Co., Republic Steel Corp., H. M. Harper Co. and Granite City Steel Co.

Howard Broemmelsick is manager of the new Memphis plant. He has been associated with Hubbell in various sales capacities since 1946, and has been in charge of the Memphis area. *Sidney T. Wright*, formerly with inside sales at the Indianapolis plant, has also been assigned to Memphis.

Engelberg Huller Names Swander

Glenn D. Swander has been named sales engineer in the southeast territory for the *Engelberg Huller Co., Inc.*, Syracuse, N. Y.

Mr. Swander, who will make his headquarters at 1408 Bordeaux St., New Orleans, La., has had wide experience in the sale of mill supply and machinery tools throughout the south. His new territory will include Virginia, Tennessee, northern Mississippi, Florida, Alabama, Georgia, and North and South Carolina.

Before joining Engelberg Huller, Mr. Swander was market manager for the Oliver H. Van Horn Co. He attended the University of Alabama and is an active member of the American Society of Tool Engineers.

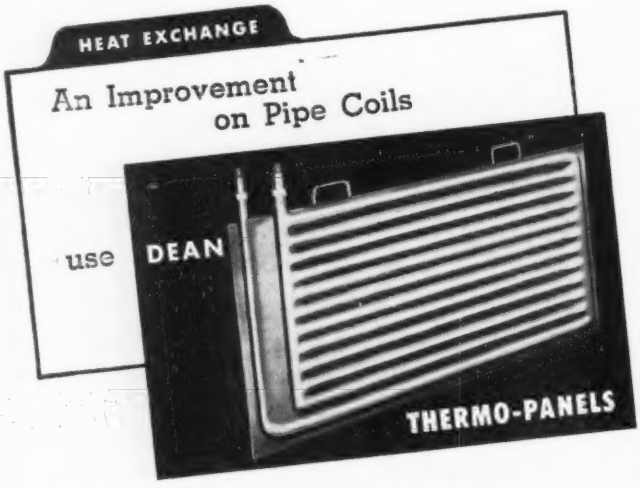
Federated Metals Division Shifts Three Key Personnel

Federated Metals Division, American Smelting and Refining Co., has promoted three men in a shift of key personnel.

George M. Baumann, assistant general manager of the Midwestern department, has been transferred to New York as assistant to *Frederick Walker*, who is assistant to the president. *James F. McQuillan*, who had been manager of the Houston, Tex. plant, has been named to Mr. Baumann's earlier position, while *M. Robert Herman*, formerly assistant to the manager of the Houston plant, moves up to manager of the Houston plant.

Born in New York City in 1914, Mr. Baumann was graduated from Columbia College and from the Columbia School of Mines, where he won a M.S. degree in Metallurgical Engineering. In 1938 he was employed as a chemist at Sand Springs and in 1939 as assistant to the superintendent of roasters at Rosita, Mexico. Since then he has held a variety of positions with the company.

Mr. McQuillan's native city is Pittsburgh, Pa., where he was born in 1911. From 1929 to 1939 he attended Carnegie Institute of Technology Night



• For use in the heating or cooling of solutions for plating, degreasing, metal washing, bonderizing, etc.

These engineered, scientifically designed heat exchangers provide performance that can be definitely anticipated. They are low in first cost . . . light weight . . . easily replaced . . . simple to clean. Available in special shapes such as "U's", "L's" and cylinders . . . and a wide range of materials, including iron, stainless steel, monel and other special alloys.

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STerling 9-5400

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF METAL FINISHING, published monthly at Westwood, New Jersey, for November 1, 1955.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Finishing Publications, Inc., 381 Broadway, Westwood, N. J.; Editor, L. H. Langdon, 381 Broadway, Westwood, N. J.; Managing editor, Nathaniel Hall, 381 Broadway, Westwood, N. J.; Business manager, Thomas A. Trumbour, 381 Broadway, Westwood, N. J.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Finishing Publications, Inc., 381 Broadway, Westwood, N. J.; L. H. Langdon, 275 Engle Street, Englewood, N. J.; Palmer H. Langdon, Closter, N. J.; Louise H. Hasselback, 14 Westmoreland Road, Alexandria, Va.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of the total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

THOS. A. TRUMBOUR, General Manager.

Sworn to and subscribed before me this 14th day of October, 1955.

W. R. CHAPMAN

(Seal) (My commission expires June 27, 1960)

School, specializing in Industrial Chemistry and Metallurgical Engineering. During most of this period he was employed at the Pittsburgh plant as chemist and assistant chief metallurgist, and thereafter held positions at this plant as chief metallurgist and plant superintendent. In 1945 he was transferred to Perth Amboy as general superintendent. He was made superintendent at Whiting two years later and manager at Houston on August 1, 1954.

A native of New York City, where he was born in 1920, Mr. Herman earned a B.S. degree in Chemical Engineering and an M.S. in Metallurgical Engineering at the University of Michigan, was commissioned in the Naval Reserve in 1941, and served until mid 1946.

Thereafter, he was employed at the firm's Perth Amboy plant as assistant to the development engineer. Positions as general foreman of the electric furnace department, general foreman of the brass plant and assistant superintendent of the lead smelter followed. In 1950, Mr. Herman was awarded a Fellowship by the Sloan Foundation for Executive Development, at the Massachusetts Institute of Technology.

Bart-Messing Appoints Distributors

The appointment of *F. H. Ross and Co.*, Charlotte, N. C., and *Ruco, Inc.* of Dayton, Ohio as distributors of Sel-Rex rectifiers and filters, has been announced by *Bart-Messing Corp.*, the manufacturer.

Established 35 years ago, F. H. Ross maintains 12 offices and warehouses from which 52 salesmen call on the metal finishing, industrial and chemical, and special equipment trade in North and South Carolina, Georgia, Alabama, Mississippi, Florida, Tennessee, and Louisiana.

Ruco, Inc., originally appointed distributor for the manufacturer's rectifiers early in 1953, is headed by *Eob Ruleff*, former Western sales manager for Bart-Messing. The Ruco organization is active in Southern Ohio, Northern Kentucky, sections of West Virginia and South Eastern Indiana.

International Rustproof Appoints Barrett

L. D. Barrett

International Rustproof Corp. announces the appointment of *L. D. Barrett* as director of research. Mr. Barrett was formerly chief chemist of Wean Herhead Co. His Master's Degree was obtained through studies at Case Institute of Technology and John Carroll University.

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Metropolitan Distributors

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Complete Service for Metal Finishing

Products Listed Below Available in New York Stock With Reasonable Exceptions

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Anodes, All Kinds	Tallow	Nickel Salts
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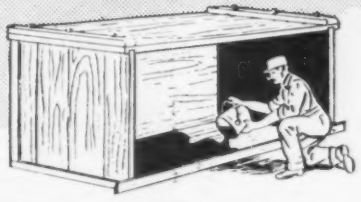
MAIZO Drying Materials

LEA Buffing & Polishing PRODUCTS

Easy to Apply RUBBERITE TANK LINING



Just heat to 300°F. and pour

Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

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EVERYTHING FOR PLATING PLANTS

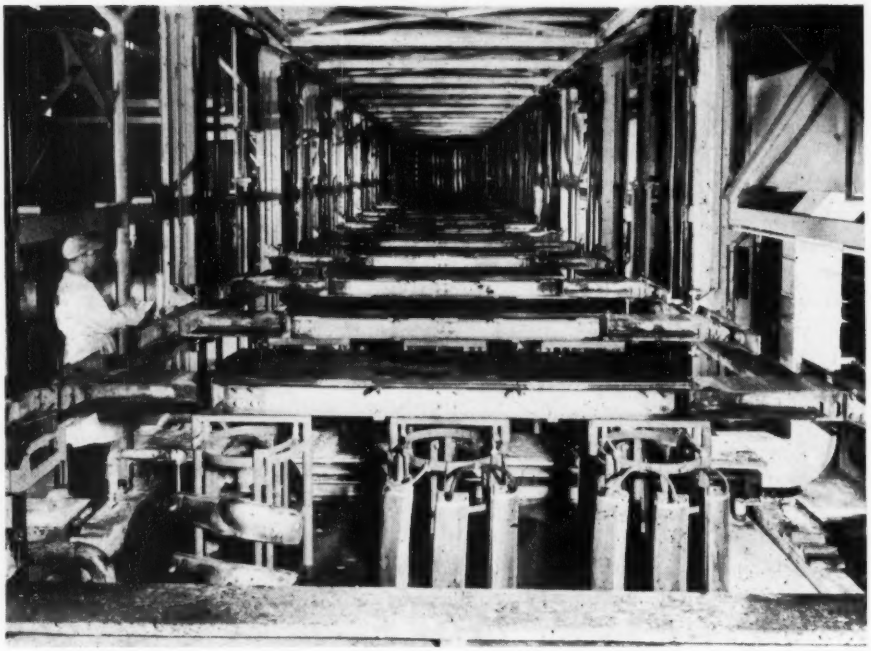
Nankervis Installs World's Largest Plating Plant

THE largest automatic plating facility in the world is now in operation at Chevrolet's new Spring and Bumper Plant in Livonia, Mich. In it, over 19,000 automobile bumpers are copper, nickel and chromium plated every day . . . one every three seconds. A giant, by any measure, the entire facility was engineered and installed by the *George L. Nankervis Company* of Detroit. An idea of its size is gained when it is realized that it comprises over ⅓ of a mile of plating machines and to fill the 149 tanks, required 906,000 gallons of solution—the equal of 109 tank cars. It is so big that the steel used in the machines alone, would have been enough to erect a thirty-eight story office building. Electrical power used would illuminate 20,000 homes.

An area of 180,000 square feet, on two floors, was required for the installation. A break with tradition was made when the plating machines and generators were put on the second floor and the accessory equipment directly below on the first. This enabled the entire system to be open and accessible without pits or trenches. Another inovation was the installation of the plating tanks *through* the second floor. Each tank extends but thirty inches above the second floor level, with the balance projecting below.

The system consists basically of three, straight line, fully automatic plating machines built by The Meaker Company. Each is 17 feet wide, 25 feet high and 535 feet long. Installed side by side, they process the bumpers through a complete copper, nickel and chromium sequence. Parallel installation permits independent operation of any of the machines for a complete plating cycle. A complete cycle consists of forty-one pre-cleaning, plating, reclaim and rinse operations.

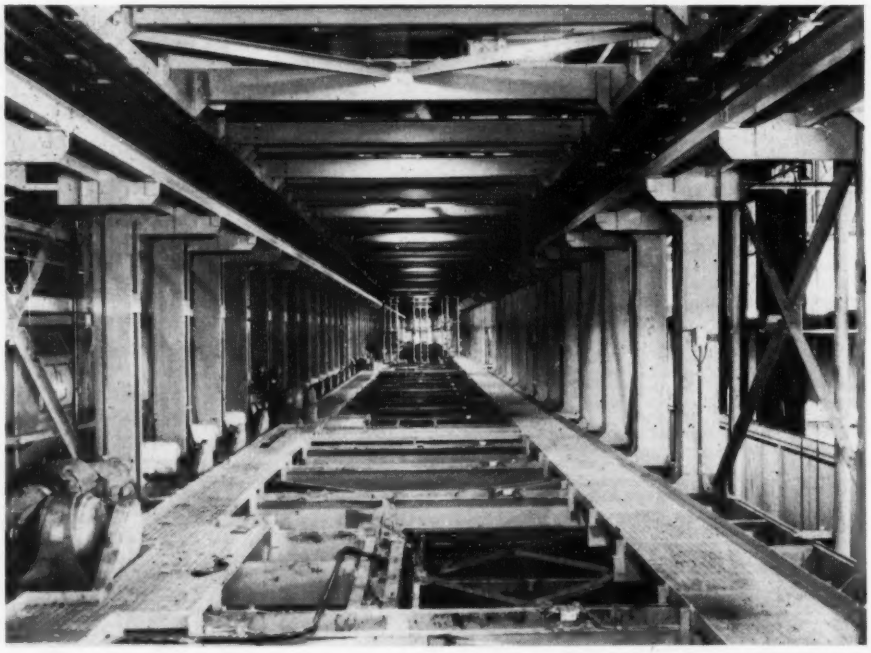
The machines are selective, batch type units, which are unique in operation. Instead of the bumpers parading through the machine "follow-the-leader" style as they do in conventional straight line machines, they actually pass each other "leap frog" style. This is the essence of batch type operation and is required because of the shape of the Chevrolet wrap-around bumper. To enable an even plate to be deposited on the curved surfaces, it was necessary to surround the bumpers with equally spaced or conforming anodes.



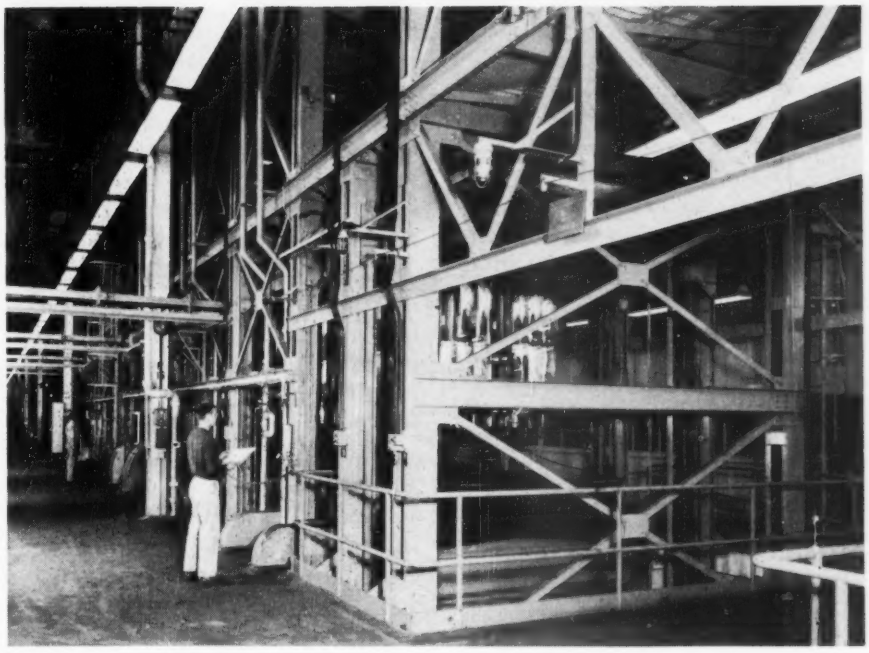
Bumpers are racked and conveyed through the machine on carriers like these—a moving load of 2,400 pounds. Pictured here are the 15 pre-cleaning tanks prior to copper plating. Every 57 seconds all the carriers pictured lift simultaneously, advance one tank and lower immersing the bumpers into solution.

This precluded any horizontal travel in the tanks. All horizontal travel had to be *above* the tanks, and as the time intervals in the various processes differed so widely (rinse 57 seconds, copper plate 25 minutes), it was necessary for the bumpers to pass each other in certain sections of the machine.

The Chevrolet bumper consists of three sections: A center bar and two end wings. (These are later bolted together under the bumper guards). The plating racks were designed to accommodate either twelve end wings or twelve center bars. Three racks comprise a load for simultaneous processing. These are in turn, supported and conveyed through the machine on free wheeling, I shaped carriers, which traverse the width of the machine, and ride on rails extending its entire



Automation in operation. Here, on the second level of the plating machine, empty carriers are returned to the starting end by a rapid transit, self demanding, shuttle system.



This Meaker fully automatic copper-nickel-chrome plating machine, one of three, is 17 feet wide, 25 feet high and 535 feet long. Here automobile bumpers are processed through 41 pre-cleaning, plating, reclaim and rinse operations.

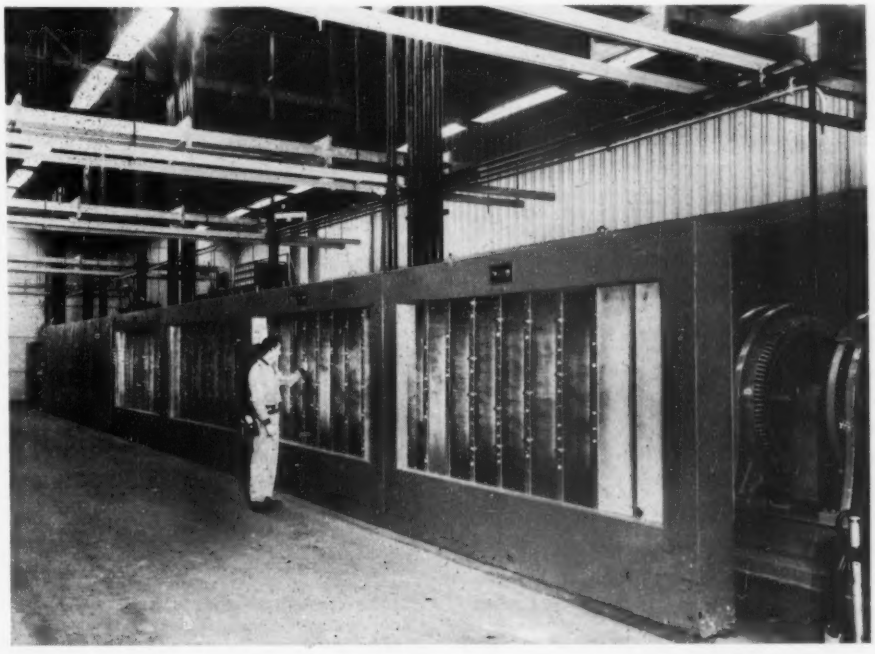
length. These rails are fixed where forward travel only is desired, such as between stations, and are movable where the work is lowered into the tanks. Each carrier, with its load of bumpers, weighs approximately 2,400 pounds.

The bumpers enter the machine on the first floor and are loaded onto plating racks. When loaded, the carrier is lifted to the second floor plating area on a screw type elevator which is an integral part of the machine. Lifting force of the elevator is two double threaded screws, four inches in diameter and twenty-eight feet long. On each is a large, free running nut which travels up and down as the screws are rotated. Each nut is supported in a structural member which actually holds the carrier. The load is counter-balanced to assure smooth operation with a minimum of friction. The elevator is operated automatically and is regulated by limit and plugging switches which stop it in a fraction of an inch even when fully loaded. All vertical movements of the bumpers, in and out of the tanks, loading and unloading, are accomplished on screw type elevators of similar construction.

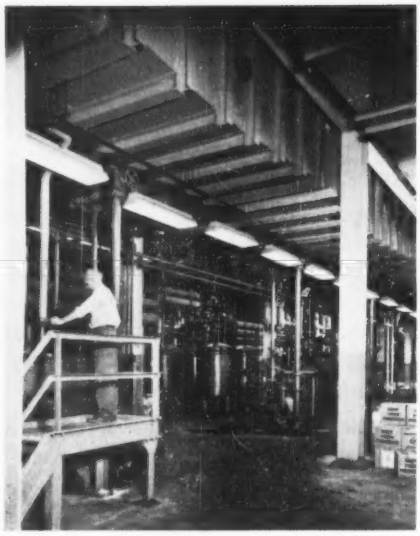
When the carrier reaches the top of the elevator, it is in perfect alignment with the machine rails. It is then rolled off the elevator and onto the rails by means of an overhead shuttle system. (The elevator immediately lowers to receive another load).

A shuttle, with a series of equally spaced pusher dogs, advances the carrier directly over tank No. 1 where it latches into place. Then the rails lower, immersing the bumpers. (The shuttle returns to be in position for the next carrier). The bumpers remain in the first tank 57 seconds. During this time another load of bumpers are racked and lifted, ready to enter the machine on the next cycle. At the end of the 57 second interval, the bumpers are lifted out of tank No. 1 and engaged with the shuttle again. This time the shuttle advances the carrier to tank No. 2 and simultaneously pulls a new load off the elevator and over tank No. 1. The rails lower again immersing both racks. Raising, lowering and advancing the bumpers for each process takes 50 seconds. This period plus the 57 second dwell time gives an operating cycle of 107 seconds. After the bumpers have gon through a series of fifteen pre-cleaning processes in this manner, they enter the copper section of the machine.

In the copper section, the carriers are advanced by a walking beam shuttle. As a load of bumpers leaves the pre-cleaning section, it is advanced to a position directly above the first copper plating tank. Again a section of the rail, the width of the carrier, lowers—immersing the bumpers. An auxiliary rail immediately comes into position to replace the movable section, allowing subsequent carriers to roll pass the filled tank. Each load of bumpers remains in the copper solution twenty-five minutes. Therefore, when the next carrier enters the copper section, 107 seconds later, it passes over the first copper tank and enters the second. This continues in sequence until all fifteen copper cells are filled. By the time the last one is filled, the first batch of bumpers are ready to be removed and advanced to



Thousands of electrical components are used in the intricate control system which automates the plating machines. Pictured here are panels of the Electro-Graphic Detector System which stand guard over all the automatic controls. If trouble develops, it is easily and quickly located here.



Unique installation of the plating tanks through the second floor. All process piping, filters, mixing tanks, heat exchangers and related components are located directly below on the first floor. 430,500 gallons of copper, nickel and chrome solutions are continuously filtered and circulated through this system.

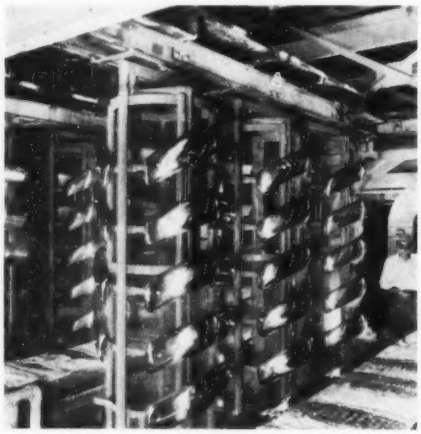
the following reclaim and rinse tanks. Therefore, it is lifted out and advanced by the shuttle over fourteen copper cells and into the first reclaim rinse tank.

While in the acid copper tanks, the bumpers are surrounded by copper anodes which are positioned to conform with the shape of the bumpers. This "nesting" assures an even .0011" deposition on both the flat and the curved surfaces. Over two hundred thousand gallons of acid copper solution is used. It is continuously filtered at the rate of 225,000 gallons per hour. As it is recirculated to the tanks it passes through a bank of heat exchangers which hold the temperature at 95°F. Hi-speed, centrifugal compressors force air into each tank to keep the solution in agitation. All the components in the circuit, pumps, filters, tanks, pipes, valves, regulators and heat exchangers are either constructed of, or are lined with, acid resistant materials.

Immediately following copper plating, the bumpers are processed through a reclaim tank. Here the copper solution is washed off, preventing it from contaminating successive baths and trapping it for reclaimation. Each week the contents of the reclaim tank are drained to a "dummy" or copper plateout tank where the copper is plated out of solution onto anodes. Scrap recovery of almost 500 pounds of pure electrolytic copper a week is realized.

Next the bumpers enter the nickel section. Here they remain in solution for twenty minutes to receive a .00075" deposit. In one of twelve tanks, holding a total of 166,200 gallons, each rack is immersed for twenty minutes. Here too, the solutions are continuously filtered and circulated through pure nickel heat exchangers to maintain an even temperature of 135°F. Filtration of the copper and nickel solutions is done at the rate of approximately 420,000 gallons per hour—the equal of about one tank car every minute. As the bumpers leave the nickel section they are immersed into a reclaim tank and several water rinses.

With the completion of the nickel operations, the bumpers are again lowered on elevators to the first floor for buffing. Returning they enter the chrome section of the machine. Here,



Bumpers emerging from hot water rinse.

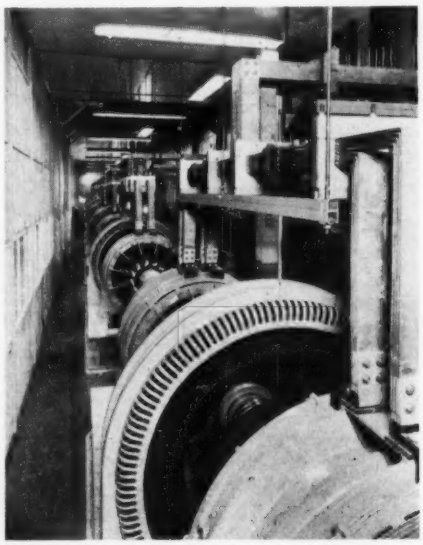
in one of three tanks, each holding 17,600 gallons of chromic acid, the final plate is deposited. A relatively quick process, it takes only four minminutes to produce the gleaming, lustrous chrome finish. In spite of the seeming simplicity of the operation, the use of chromic acid required special care. Each tank was lined with vinyl plastic to withstand the particularly oxidizing effect of the acid. And to protect the plastic from mechanical damage, each tank was brick lined. A high velocity exhaust system was used to remove the irritating acid fumes. Before exhausting the fumes they are thoroughly washed to remove all the chromic acid, thus preventing any staining "fall-out."

Following chrome plating, the bumpers enter a reclaim tank and several water rinses. They are then removed from the racks and loaded onto conveyors for delivery to the Shipping Department. Recovery of the chromic acid from the reclaim tank is accomplished through a distillation system. This not only contributes to economical operation as the acid is re-used, but prevents it from being dumped into the sewer system for eventual pollution of public waters.

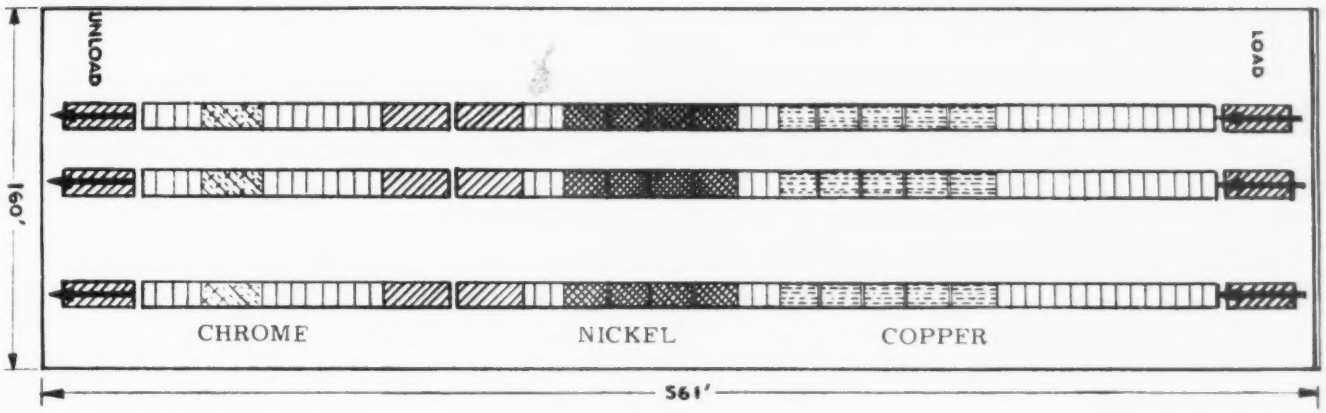
All the sequencing, selecting and indexing of the entire machine is completely automatic—a real triumph in automation—being done with stepping relays, limit switches, counters, timers and similar components.

It is possible to operate the machine in either of three ways: *Automatic*, *Manual* or *Storage*. With the selector switch on *Automatic*, the machine performs all operations automatically, on a 107 second cycle. Every 107 seconds a carrier of unplated bumpers is taken into the machine and simultaneously another is discharged with plated ones. All intervening operations are done either in 107 second intervals or in multiples thereof. Should any operation get out of sequence or time, the machine automatically stops. Then by simply pressing a pushbutton, the operation can be manually completed, putting it back into sequence. When the finished bumpers are removed, the empty racks are lifted on chain elevators, in cycle, to the upper portion of the machine for rapid transit, by means of shuttles, back to the loading end of the machine.

Operation on *Manual* is used to set-



48 Chandeysson motor-generators supply 625,000 amperes of D.C. power for the electroplating processes. Enough power is generated to illuminate 20,000 average size homes. Over a half million pounds of copper bus bar was used to connect the generators to the plating tanks.



PLAN VIEW - PLATING AREA

up the machine for automatic operation and to operate it experimentally. On *Manual* it is possible to start a load of bumpers in one end of the machine, and to advance it through the entire machine, step by step, by operating pushbuttons adjacent to each station.

Operation on *Storage* means that the empty plating racks remain at the top of the machine instead of feeding down to the loading section. In preparation for week-ends, the last two hours are run on *Storage*. The machine operates as usual, except that as the racks are unloaded they stay in the rack storage area above the machine. This allows free access to the entire machine for inspection and maintenance.

Installed as a part of the control system are unique Electro-Graphic Detector Panels for maintenance purposes. These consist of large illuminated panels showing the complete electrical system in schematic diagram —with wired-in checking circuits. Each point on the schematic which represents a contact, such as a limit switch, contactor, or timer, is actually wired to that particular component, either on the machines or in the control panels. Therefore, when it is necessary to check a component or circuit, an electrician simply locates the component on the Electro-Graphic Panel, and using a test probe, checks the circuit for correct operation. This eliminates the necessity of going directly to the components for testing and makes possible the checking of the machines with the power on. Over 3¾ million feet of wire—or 710 miles

Filter your solutions!*

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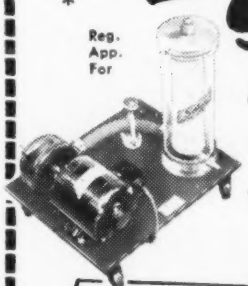

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Model LS1-10 . . . Cap. 100 gal/hr
H.T. Lucite Filter Assembly.
Stainless pump . . . totally enclosed Motor . . . portable . . .
Wt. 40 lbs . . . 12"x16"x16" high.
. . . Distributors in principal cities.
Write for literature.

PARTIAL LIST OF MODELS

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11"x14"x12"	30 lbs.
LSI-10	100 gal/hr	12"x16"x16"	40 lbs.
ASI-300	300 gal/hr	2'x2'x2'	125 lbs.
ASI-600	600 gal/hr	2'x2'x2'	150 lbs.
RLS-1200	1800 gal/hr	2'x3'x3'	300 lbs.

SERVICE . . . Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.
DESIGN . . . **Filter Assembly** fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. **Filter Tubes** of cotton, dynel, porous stone or porous carbon. **Pumps** fabricated of Hastelloy, stainless 316 or plastic; centrifugal or self-priming. **Motors** drip-proof, totally enclosed, or explosion proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. **Hose** — special acid and alkali resistant. **Base** — Linen Phenolic laminate on rubber tire ball bearing casters.

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Easy to make up in the first place!
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INCO Monel Pickling Equipment

—was used in the installation of the control and checking circuits.

Direct current, low voltage power for plating processes is supplied by forty-eight Chandeysson motor-generator sets ranging in size from 7,500 amperes at nine volts to 20,000 amperes at twelve volts. Total D.C. output of the generators is 652,000 amperes. Over a half million pounds of copper bus bar was used to connect the generators with the tanks.

Ventilation for all tanks requiring it is supplied by thirty blowers and six air washers having a combined capacity of 979,500 cubic feet per minute. Hoods run the width of each tank to draw off the vapors at the source keeping the area adjacent to the machine free from contamination.

Brahm Joins Pennsalt Chemicals Sales Staff

Clay R. Brahm recently joined the sales staff of the *Pennsylvania Salt Mfg. Co.'s* Metal Processing Chemicals Dept. He is a native of St. Louis and has been assigned to the company's St. Louis territory.

Mr. Brahm, a chemical engineer

Clay R. Brahm

and a graduate of the University of Missouri, was associated with the Allied Chemical & Dye Corp. for the past 5 years. He will replace *Frank Wilcher* recently transferred to Louisville.

Metallurgical Products Co. Resumes Anode Production

Metallurgical Products Co., commercially dormant for the past six years, has resumed production as its president, *I. W. Wilenchik*, gets back into harness again.

At the time of his retirement on doctor's orders in 1949, Mr. Wilenchik had brought his company to a dominant position in the electrolytic metals field. It was, in fact, the largest manufacturer of chill-formed prime electrolytic copper anodes, shipping to customers throughout the United States and ten foreign countries. During those years Mr. Wilenchik had personally played a prominent part in the industry, developing new processes and alloys, and serving the government on various assignments as an expert on industrial metals.

The six year period of retirement was actually a transfer of activities for Mr. Wilenchik, enabling him to devote more time to research, and to continue experiements which had been started earlier, but which had been pushed aside by the pressure of business. One of the outstanding results of this research was lithium copper, the most powerful deoxidizer and degasser for high conductivity copper. He also developed a deoxidizer and

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3 different sized barrels—5 gal., 1.1 cu. ft., and 2 cu. ft. are tumbled at one time by a ¾ H.P. motor through a variable speed drive.
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Eliminates heavy metal impurities, including copper.
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degasser for aluminum bronze.

In 1954 he served on the Government Advisory Board to review metal specifications, allocations, and price regulations. During World War II and the Korean War he had served in Washington in a similar capacity.

He is a member of American Institute of Mining and Metallurgical Engineers, American Society of Metals, American Electroplaters' Society, American Society for Testing Materials, and the Franklin Institute.

Stanley Johns New St. Louis Wyandotte Chemicals Sales Manager

Stanley Johns was recently promoted to district sales manager of the St. Louis office of *J. B. Ford Division, Wyandotte Chemicals Corp.*

Born in South Wales, Mr. Johns has attended both Detroit Institute of Technology and University of Michigan Extension Service. Before joining Wyandotte's Detroit sales staff in 1945, Mr. Johns had more than seven years of chemical and production experience with three nationally known manufacturers in the Detroit area. Transferred to J. B. Ford Division's St. Louis office in 1946, Mr. Johns was next attached to an Army Air Force electro-chemical unit at Wright Field and returned to his sales position in St. Louis in 1947.

Stanley Johns

Mr. Johns will supervise a sales force covering Missouri, Arkansas, Western Tennessee and Southern Illinois.

Frankel Joins General Ultrasonics

The General Ultrasonics Co. of Hartford, Conn. announces the appointment of *Herbert A. Frankel* as engineering and sales representative. Mr. Frankel, an M.I.T. trained metallurgist and management engineer, was formerly general manager of Foundry Services, Inc. He will cover the New York and New Jersey area for the application of the firm's ultrasonic processing equipment in the fields of electroplating, cleaning and descaling, pickling, and for research and development purposes.

A New York office has been established at 507 Fifth Ave., New York 17, N. Y.

James H. Gardner Advanced by National Research

The appointment has been announced of *Dr. James H. Gardner* as technical assistant to the director of research, of *National Research Corp.*, effective September 1.

Prior to this appointment Dr. Gardner was assistant director of the petrochemicals department, having origi-

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CORROSION RESISTANCE UP 30% TO 100%

With Nickelite you can get 13 to 22 hours of salt spray exposure with 0.00006 inch of barrel nickel, instead of 11 to 13 hours. Actual salt spray tests show even greater improvement with thicker deposits. And you're saving money, too!

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nally joined the staff in August, 1951 as a project manager. Prior to that time he was employed by the Shell Oil Co. as a technologist in the Houston refinery. While in Houston, he was also a lecturer in chemical engineering at the University of Houston. Dr. Gardner is a native of Salt Lake City and obtained his Bachelor's degree in Chemical Engineering at the University in Cambridge.

Schumpelt Joins Sel-Rex Precious Metals

Dr. Karl Schumpelt has been appointed chief metallurgist for *Sel-Rex Precious Metals, Inc.*, Belleville, N. J. Well known in the precious metals field for his work with rhodium electroplating techniques, and for his contributions to electrochemistry of the platinum metals in general, Dr. Schumpelt held the position of chief electrochemist with Baker & Co., Inc., for 23 years and with the Forstner Chain Corp. for 5 years.

Dr. Schumpelt is a graduate of the Berlin Institute of Technology, and the University of Berlin, where he received the degree of Ph. D. He will

Dr. Karl Schumpelt

devote most of his time in research and development at the company's Belleville plant, where a fully equipped metallurgical laboratory has been set up for his use.

Engelberg Huller Names Sales Engineers

J. D. Kraeger has been named sales engineer in the west coast territory for the *Engelberg Huller Co., Inc.*, Syracuse, N. Y., manufacturers of abrasive belt machinery.

Mr. Kraeger will make his headquarters at 267 North Rosemont St., Los Angeles, Cal. His new territory will include Washington, Oregon, California, Nevada, Idaho and Arizona. He attended Compton College, Compton, California and was previously a machinery salesman for Fred C. Paulsen Co. of Los Angeles.

Cecil E. Gordon has been named sales engineer in the southwest territory.

Mr. Gordon will make his headquarters at 3327 South Marsalis, Dallas, Texas. His territory will include Texas, Louisiana, New Mexico, Arkansas, Oklahoma and southern Mississippi. Mr. Gordon is a member of the American Society of Tool Engineers. He had extensive experience in industrial sales with the Perry Machine Company and the Halliburton Oil Well Company before joining Engelberg Huller.

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OBITUARY

EDWARD MAGNUSON

Edward Magnuson passed away in his sleep on October 16, 1955. He is survived by his widow, *Ingrid C. Magnuson;* a daughter, *Cecilia M. Roberg;* a son, *Pehr Edward Magnuson* and a granddaughter, *Elizabeth Roberg.*

Born in Kalmar, Sweden on July 4, 1878, Mr. Magnuson went to sea as a young boy. Among the ports of call was the United States and the young man soon made that his adopted land, becoming a citizen in 1913. He worked as a soap maker and devised various formulae which earned him a reputation in the industry. Mr. Magnuson was a pioneer in the detergent field and helped to build several of the leading companies in that field. In 1923 he organized his present firm, the *Magnuson Products Corporation,* and served as its president until his death; he also owned and headed *Canadian Permag Products, Ltd.* in Quebec.

Known for his many charitable interests, Mr. Magnuson was closely identified with The Swedish Hospital in Brooklyn of which he was president for ten years.

Mr. Magnuson was decorated twice by the late King Gustaf of Sweden as follows: Sweden-Delaware Tercentary medal of 1938 and "Chevalier of the Order of Vasa" on Nov. 29, 1941.

Other memberships: Life member of Strict Observance No. 94, F & AM; Life member of Sylvan Chapter No. 188 R.A.M.; Constantine Commandery No. 48, K.T.; Nobel of Mystic Shrine (Kismet Temple), Balder Chapter No. 829, O.E.S., Kiwanis Club, Swedish Chamber of Commerce, Circus Saints and Sinners Club, Brooklyn Club, New York Railroad Club, The American Society of Swedish Engineers, John Ericson Society, and the Swedish Society.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

1956 Convention

Plans for the 1956 Convention are proceeding according to schedule. On September 16 a general committee meeting was held at the Statler in Washington, D. C., which is the Headquarters Hotel for the Convention. Among those present were *Clyde Kelly,* president of the A.E.S.; *Pete Kovatis,*

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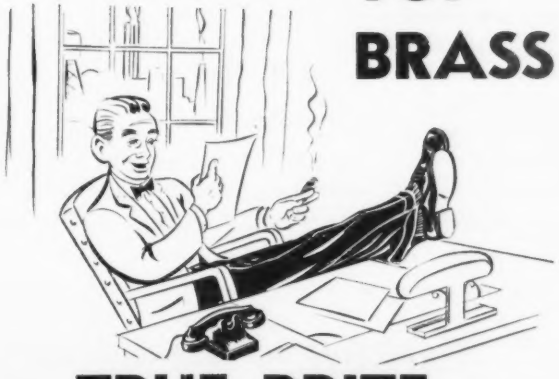

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New improved equipment assures highest quality and production control

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executive secretary; *Joe Duffy*, representing the M.F.S.A.; *Archie Doria* and *Joan T. Wiarda*.

Vincen J. Hughes, Jr., in charge of Plant Visitation, reported that four trips are planned. At the Bureau of Engraving, conventioneers will see the operations of electroforming in iron and nickel and chromium plating, which are steps in reproducing printing plates.

The Bureau of Standards has planned a tour featuring the electrodeposition section, which is the source of a large percentage of the technical guidance our industry has received for a number of years.

The Potomac Electrotype Company will demonstrate a high precision electroforming operation. The fourth trip is scheduled for an industrial plant in Baltimore, Md. Details will be available later.

Many of these in attendance will want to combine the Convention with a vacation trip. The program is being planned with a view to allowing as much time as practical for sightseeing in Washington. A sightseeing information desk is expected to be available, to help those who want to go out on their own. From time to time short trips will be suggested which can be made in addition to the planned tours.

If the vacation time available is long enough, there are excellent beaches on the Chesapeake Bay. Historical Baltimore, the birthplace of the Star Spangled Banner, is only 40 minutes from Washington, and there is a train every hour. While in Baltimore, Haussner's Restaurant at Eastern Avenue and Clinton Street is an excellent place to sample typical Maryland seafood delicacies such as Chincoteague oysters and the many delectable dishes concocted from the Chesapeake Bay Blue Crab. The Haussner Art Collection, on display in the restaurant, includes paintings, sculpture, and art objects from all over the world, and is itself worth the trip.

To the south, Williamsburg, Va. is a restored colonial town rich in the heritage of Revolutionary times. The home of Thomas Jefferson at Monticello, Va. was designed, and the building supervised by, that versatile statesman.

Detroit Branch

The annual education session of the Detroit Branch will be held on Friday, December 2, 1955, at the Statler Hotel. Subject of the session will be the nickel story.

The banquet will be held on Saturday evening, December 3rd.

Los Angeles Branch

Ercell Stevens, field engineer of the Abrasives Division of Norton Co., Worcester, Mass., and *David H. Greene*, chief chemist for Mido Products of Torrance, Cal., Norton distributors, presented what might be called a "double-barreled" presentation on barrel finishing at the October 12 meeting of Los Angeles Branch, AES.

The program attracted an audience of 110 members and guests, including the wives of six Norton and Mido executives.

Mr. Stevens gave a talk on "What's New in Precision Barrel Finishing," which he offered following the showing of a film of the same title. The newest developments in conventional type barrels, bottle and tilting barrels, and tumbling media were depicted in the film, along with model installations of tumbling media, old and new, and finished parts. To better highlight what is new in precision barrel finishing, Mr. Stevens presented slides of and reviewed some old methods.

A companion talk on tumbling compounds was presented by Dr. Greene. He defined the chemical constituents of tumbling compounds and cited the various purposes for which different types of tumbling compounds are suitable. He touched upon the general nature of descaling compounds and their mechanical function, which he cautioned, should always be geared to the job in hand.

Dr. Greene also discussed the part wetting and sequestering agents play in barrel finishing, as well as the proper use and selection of detergents and inhibitors. In conclusion he outlined different types of barrel finishing compounds for various metals, such as steel, ferrous metals, etc.

Mr. Stevens and Dr. Greene conducted a Question-and Answer forum at the conclusion of their formal talks.

Branch president *Earl W. Arnold* conducted the business session and presided over the initiation of six new members. These were: *Alexander J. Clauss* and *Robert W. Warner* of L. H. Butcher Co.; *Joseph P. Byinowski* and *Emmet J. Coan* of Signal Polishing Co.; *Albert D. Baird* of Consolidated Buff Co.; and *Lawrence Sherman*.

George Hetz, reporting for research committee chairman *Tony Stabile*, announced that Sundmark Supply Co. and Barber-Webb Co., both of Los Angeles, had been signed up as sustaining members, bringing the branch's total in that category to 18.

Pittsburgh Branch

Pittsburgh inaugurated the new season with its first meeting at the Sherwyn Hotel's Avalon Room, September

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use STRIPODE
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Users are enthusiastic about STRIPODE. Here's what they say, "Speeds up removal of nickel plate"; "Protects the metal from pitting and roughening"; "Uses less acid"; "Gives marked savings by eliminating sand blasting and severe buffing operations". Try it in your plant.
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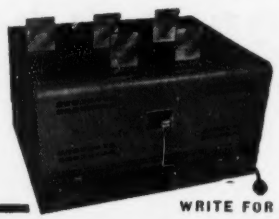
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7th. The meeting was preceeded by a very fine dinner put on by the hotel's new caterer.

At the beginning of the short business meeting we were pleased to welcome a new member into our branch, *Robert S. Vaupel*, two transfers, *R. M. Burford* from Buffalo and *Frank W. Mountain* of Philadelphia, and accept the applications of two prospective members, *Earl Johnson* and *Sirwell E. Johnson*. We were hosts to five guests for the evening. It was announced that during the drawing for the monthly door prize a second name would be drawn, but the name would not be announced until the dinner preceding the October meeting and if he was present he would receive the meal, compliments of the branch. This idea has been initiated to stimulate attendance at monthly dinners.

After the customary committee reports the meeting was turned over to Librarian *Jim Crain*. He introduced the speaker for the evening, *Dr. Richard D. Hoak* of Mellon Institute of Industrial Research who directs the Water Pollution Abatement Fellowship, sponsored by the American Iron & Steel Institute. The subject of his talk was "Plating Wastes and Stream Pollution Control." Dr. Hoak surveyed our water sources, rate of use, types of uses and potential promising methods for increasing, extending or recovery of water. He pointed out that stream pollution is a matter of education, finance and intelligent legislation. Education is the most important since most stream pollution is due to an ignorance of the potential dangers involved.

During the brief pause for refreshments Dr. Hoak drew the name for the door prize and the free dinner. *Herb Schram* was the lucky winner of a beautiful brass barometer presented by *Frank Mountain* of Hanson-Van Winkle - Munning Co. After a brief intermission for refreshments and a lively discussion period upon part plating room wastes play in stream pollution, the meeting was concluded.

Herb Schram
Secretary

Chicago Branch

The September meeting of the Chicago Branch found the officers and the members enthusiastic and inspired to new activities after their summer of rest. The first speaker of the new season was an old friend, *Arthur Logozzo* of the Nutmeg Chrome Corp. in Hartford, Conn. He is a past-president of the A.E.S., has been active in the Society's affairs for nearly thirty years and is a contributor of an annual award for the best paper on chromium plating presented to the National Society each year. Aside from the fact that he is an excellent speaker, Mr. Logozzo's presentation was of considerable interest. In essence, it was a movie tour through his shop, showing various types of chromium plating jobs as handled in production. His commentaries throughout the film and the film itself pointed up the necessity for good technique, proper equipment and cleanliness to produce high quality hard chromium deposits. Following the presentation, a lively discussion period indicated the interest of the members and their guests (members of the Chicago Electroplaters' Institute).

The September panel of experts was *Walter Warner* of the Kocour Co. on "Buffing Compounds" and *Clarence R. Kolzow* of Western Electric Co. on "Plating and Organic Finishes."

At the August business meeting, the branch saluted *Rudy Hazucha* on his forty years of active, continuous membership and uninterrupted attendance. Throughout those years he has contributed much to the growth of the branch and to the success of its affairs.

Jerome Kuderna
Publicity Chairman

Indianapolis Branch

The first meeting of the Indianapolis Branch was well attended when forty members met on September 7th at the Fox Steak House. Guests included *Keith D. Ford* of the Dayton Branch and *Tom O'Brien* of the Chicago Branch. The usual form of business opened the meeting with reports by the secretary and treasurer.

The first item of business was the Research Fund and in a motion by *John Hood* and seconded by *Cliff Cough*, $100.00 will be paid to this fund. Motion was carried. Under new business, discussion followed about organizing a class in electroplating. *Dr. Abraham Max* was appointed chairman of this and will report at next meeting. The annual dinner-dance will be April 28, 1956 at the Indianapolis Athletic Club. *Bert Hawhee* is general chairman of this. One new member was voted into the branch. He was *David H. Bender*, 1220 N. Leland St. Indianapolis, Ind. Dave is the son of *Roman Bender*. The next regular meeting will be in Columbus, Ind. and the exact date will be announced in a few days. *John Holland* is in charge of arrangements along with the other Columbus members.

The program for the evening was

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announced by *Frederick Anderson*, librarian. *Robert Peters*, Heil Process Equip. Corp., Cleveland and also secretary-treasurer of the Cleveland Branch was the speaker. He talked on "Tank Linings.". He spoke of non-metallic coatings and considered the surface to be covered, materials to be used, ceramics, glass, carbon, wood, cement, paint coatings and porcelain. Factors also considered were the availability of the coating and the service life of the material. Mr. Peters showed several colored slides of various objects covered with different coatings.

President *Herbert Kennedy* again thanked the immediate past-president for his many helpful suggestions. Mr. Lundberg acknowledged this. The meeting adjourned at 9:40 P.M.

Edna Rohrabaugh
Secretary

Newark Branch

The first meeting of the Newark Branch for the 1955-56 season was held on September 16th with Vice-President *William Grigat* in the chair for *Tom Austin*, present but just out of the hospital.

The roll call of officers found all but *George Wagner*, *John Gumm* and *Clifford Struyk* present. The business meeting consisted of accepting six applications, transferring *A. Nortof* to Cleveland and *David Roney* to Newark from Pittsburgh. *Dodd Carr* reported the Newark school for electroplaters moving into the final preliminary phases with 32 having paid the enrollment fee.

Gustav Bittrich then introduced *Francis Eddy*, second vice-president of the AES who, in response to many requests at dinner prior to the meeting, described the recent flood damage in Connecticut briefly. Frank then discussed Society membership in terms of advantages to members and value of more members to the Society and each branch, urging that efforts be made to increase branch rolls.

The chief speaker of the evening, *John Swift* of Swift Industrial Chemical Co., Canton, Conn. then presented an interesting talk on "What Every Plater Should Know About Metallurgy." Limiting his comments to ferrous metallurgy Mr. Swift described steel making and forming, pointing out the different types of steel and the divers working operations which yield surfaces of varying quality and response as far as the plater is concerned. Numerous slides showed examples of the types of steel and served to point out that "all the platers' difficulties are not of his making—some of them are due to the use of the wrong steel."

Frank Eddy was called back to report to the Newark Branch on the Cleveland Convention after which both speakers were given a rising vote of thanks.

At the conclusion of the Educational Session the sixty-five members present spent a pleasant hour chatting fortified by change, sandwiches and beer.

D. Gardner Foulke
Secretary

Los Angeles Branch

Los Angeles Branch opened its fall schedule of meetings in Rodger Young Auditorium, Los Angeles, on the night of September 14th with a full-house attendance of 95 members and guests.

President *Earl W. Arnold* presided. In order to stimulate membership promotion, *L. Truman Stoner*, membership chairman, announced that the board of managers had authorized a membership drive which is to endure from September, 1955, to March, 1956, inclusive.

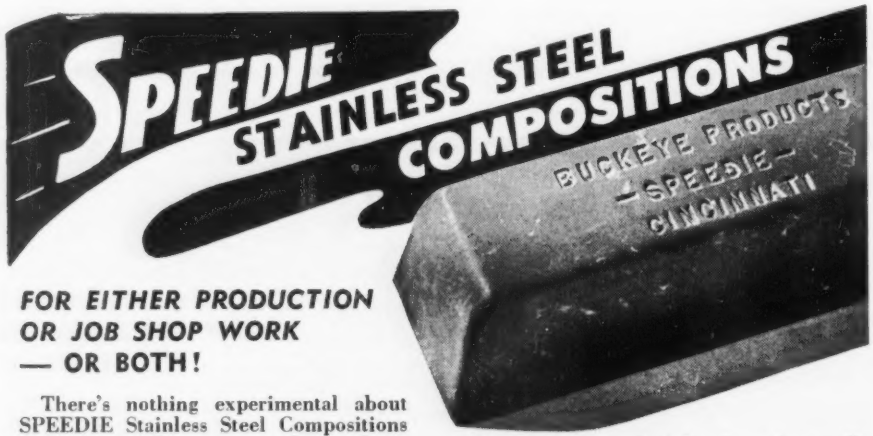
Prizes of a $50 and a $25 gift certificate will be awarded to the members who sponsor the largest and second largest number of accepted applicants during the drive. All members are eligible to participate except officers and the board of managers. The prizes will be awarded at the March, 1956, meeting.

Stoner announced that the acquisition of 75 to 100 new members is not beyond accomplishment if the branch diligently applies itself to going after the large number of prospects in the Southern California finishing industry who are eligible for membership in the A.E.S.

As a starter, four new members were installed and applications received from six others at the September meeting. Installed were *H. G. Vorking*, *John A. Beards*, *Lawrence Sherman*, and *Carl Virginia*. The applicants included *Herman Ey*, *Steven Martin*, *Albert Baird*, *Robert Warren*, *Joseph Bylinowski*, and *Emmet J. Coin*.

Tony Stabile, Research Committee chairman, presented a brief report on the national convention, which is to be amplified by more complete reports from the delegates at the October meeting.

A dozen or so members participated in a discussion on whether or not it would be practical for Los Angeles Branch to urge the Supreme Society officers to "do something" about improving the editorial content of Plating, the A.E.S. official publication. The concensus of those who participated in the discussion was that the editorial matter in Plating today is slanted "above the head" of the average plater and is dominated by too many extremely technical reports of research projects and reprints of convention papers.



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The matter was referred to the Board of Managers for recommendation. The board is to report at the October meeting on whether any action should be taken in calling the viewpoint of the local branch to the attention of the national office.

Harold A. Kahler of Waukegan, Ill., assistant to the vice-president, Promat Division, Poor & Co., addressed the educational section of the meeting on "Chemical Treatment of Aluminum." *Norman K. McEwan*, educational chairman, announced that Mr. Kahler made a special trip from Waukegan to Los Angeles to address the branch when a previously scheduled speaker could not keep the engagement.

Mr. Kahler presented a comprehensive treatment of his chosen subject. Declaring that no new ideas and developments in chromates had been introduced since 1940, he covered present processes, and techniques in full detail; including cleaning, corrosion resistance factors, and other points. He also included a brief report on an A.E.S. Research Committee conference held recently in Detroit, Mich. which he had attended.

A round table discussion on matters pertaining to chemical treatment for aluminum was held following the conclusion of his formal talk.

Central Michigan Branch

The Central Michigan Branch met on Saturday, Sept. 17, at the Mason Country Club, Mason, Mich. for their annual golf stag and picnic. Golf and door prizes were awarded by the committee chairman, *William Mogle*, who later received a rising vote of thanks from the 95 members and guests who enjoyed a pleasant day of golf and an excellent lunch and dinner.

G. S. Woodruff

Philadelphia Branch

On Saturday, Nov. 19, the Philadelphia Branch will hold its annual educational session and banquet at The Benjamin Franklin, Philadelphia. The educational session, scheduled for 2:00 P.M., will feature talks by: *Henry Strow*, True Brite Chem. Prods. Co., "Advanced Techniques in Copper Plating;"

Dr. A. Kenneth Graham, Graham, Crowley & Associates, "New Concepts With Respect to the Use of Nickel or Nickel-Chromium Coatings"; *Richard S. Scott*, The Udylite Corp., "Electrical Circuits in Electroplating."

The banquet at 7:00 will be followed by a show and dance.

I. Wm. Marcovitch

A.E.S. Sponsors Two More Research Projects

Two new research projects have been approved by the *American Electroplaters' Society*, it was announced by Research Chairman *Leslie C. Borchert* of Houdaille-Hershey Corp., Detroit, Mich. One on micro-throwing power will be conducted at the Virginia Institute for Scientific Research at Richmond, Va. under the direction of *Dr. Henry Leidheiser, Jr.* of the institution and the other on the mechanism of plating (polarization, cathode reactions, etc.) at the University of Penna. under the direction of *Dr. J. O'M Bockris* and *Dr. B. E. Conway* of the John Harrison Laboratory of Chemistry at that University. The two new projects increase the number of A.E.S.-sponsored researches to eight.

Dr. R. A. Schaefer of Clevite-Brush Development Co., Cleveland, Ohio, National Past President of the A.E.S., is district supervisor responsible for the two new projects. The project directing subcommittee are as follows: Univ. of Penna.—*E. R. Bowerman, Jr.*, Sylvania Electric Products, Chairman; *Dr. W. Blum*, Nat'l. Bureau of Standards (retired), and *Dr. O. Kardos*, Hanson-Van Winkle-Munning Co. At the Va. Institute for Scientific Research, the project directing subcommittee includes *Dr. W. R. Meyer*, Enthone, Inc., Chairman; *R. McKay*, International Nickel Co. (retired) and *R. T. Putnam*, Pratt & Whitney Aircraft Div., U.A.C., E. Hartford, Conn.

The research program is made possible through sustaining memberships by more than 300 industrial firms and a yearly dollar assessment of the more than 7,000 A.E.S. members throughout the world.

News from California

By Fred A. Herr

George Hetz was promoted from manager of the plating supply department to assistant sales manager of Mefford Chemical Co. of Los Angeles, effective September 1. Hetz came to the firm in 1941 after nine years of service with McKesson-Robbins Co. in Burlington, Iowa, and Los Angeles. George pointed out that McKesson-Robbins took over Mefford in the fall of 1954 so that, after a lapse of 14 years, he once again finds himself working for his original bosses. He rose to his present post as Mefford's assistant sales manager through various positions as inventory clerk, head of the sales desk, salesman in the metal finishing division, and manager of the latter division, to which he succeeded when *John Millhorn* resigned

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to open up his own plating supply business two years ago.

Kaykor Industries Names New West Coast Representative

Appointment of *G. Gordon Schmuck* as West Coast representative of Kaykor Industries Division of *Kaye-Tex Mfg. Corp.*, Yardville, N. J., was announced recently. Mr. Schmuck will be responsible for contacting fabricators, applicators, and the chemical processing, food processing, and metal finishing - electroplating industries in the area, providing engineering assistance in the selection and application of Vyflex polyvinyl chloride materials for corrosion resistant construction. Mr. Schmuck's West Coast office is at 1335 Yukon Way, Novato, Calif. The telephone number is Twinbrook 2-2179.

Electro-Chem Mfg. Co. of Burbank, Cal., has announced a $100,000 expansion of its hard surfacing program which involved the acquisition of the metal finishing plant of the William R. Whittaker Co. at 2124 E. 51st St., Vernon, Cal., and the addition of considerable amounts of new equipment to the holdover facilities acquired in the Whittaker plant purchase.

The plant was expected to be ready for operation by November 15. It contains 9,000 square feet of floor area. To the sulphuric acid anodizing and chromic acid anodizing facilities which were taken over from the Whittaker company, Electro - Chem has added two new hard anodizing and two hard chromium tanks. Facilities for impregnating aluminum castings have been installed as well as equipment for pressure testing castings.

The firm has also installed a new prototype fixture department which is equipped to enable the company to make any type and shape of plating fixture or jig right on the premises.

Electro-Chem's original shop at 2429 Avon St., Burbank will be continued in operation for hard surfacing aluminum. General offices of Electro-Chem Mfg. Co. and the quarters of Electro-Chem Research Labs. have been moved from Burbank to the Vernon address.

The firm is the only plating concern in the country specializing exclusively in hard chromium plating on aluminum. This type of finishing, which the company started in Burbank, will now be conducted at a greatly expanded scale due to the new faciliites. The hard surfacing plating is done on landing gear components, hydraulic cylinders, pump face plates, piston rods and missile parts.

Myron A. Miller is president of the firm; *William J. Fullmer*, vice-president; *Richard Golen*, sales manager; and *Donald MacClennan*, chairman of board of directors.

The plant of Plating Engineering Co., operated at 4057 Goodwin Ave. in the Glendale area of Los Angeles by *William "Bill" Meade*, was almost completely destroyed by fire on September 11.

It was one of the more versatile plants in Southern California and was

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WE WANT new products to sell. We want new ideas to develop for the national metal finishing market. Our active sales force is your assurance of volume. Our successful launching of new products such as anodes, automatics, filters, and rectifiers has given us the experienced background to market your line. Our technical staff will develop or service your product, our manufacturing facilities will produce it, and our sales organization will distribute it nationwide with profit and protection for you.
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equipped for plating aluminum, hard chromium, copper, tin, chromium, bright nickel and zinc. Meade's work is mostly on airplane parts.

The smouldering ruins had barely cooled when Bill was already busy on plans for a new plant. But while these develop, he had made an effective arrangement with two other plating shop owners to process his orders. He has leased space, tanks and auxiliary facilities in the shops of Excello Plating Co. and Technical Metal Finishing Co., both in Glendale, and has moved a part of his personnel into those shops to turn out his own job contracts. The deal works out much like that of a film producer with no studio of his own, who leases cameras, props and other facilities in another studio to shoot a script.

Andrew J. Ospring, better known as "Carload Andy," who retired as a plating supply salesman several years ago, reports that he has come out of retirement on a part-time basis and is once again calling on friends in the San Fernando Valley finishing shops, where he counts them literally by the hundreds. Andy has concluded an arrangement to serve as sales engineer for Joseph B. Kushner of Stroudsburg, Pa., in introducing the Kushner "Tank Doctor" to Southern California platers. It's a clever trouble-shooting chart which provides platers with quick reference to practical shop operating information.

Hal Wanamaker, owner for the past five years of Avalon Plating Co. at 816 S. Date St., Alhambra, Cal., reports sale of the plant to *Joseph Johnson*, formerly operator of the Western Metal Finishing Co. of Los Angeles.

Wanamaker has established Avalon Deburring Co. at 1934 Cogswell Road, El Monte, Cal. He announces he will specialize in ball burnishing, deburring, polishing and buffing on a job shop basis.

A visitor to the West Coast in mid-October was *Ercell Stevens*, field engineer, Abrasives Division, Norton Co., Worcester, Mass. Mr. Stevens conferred with Norton district representatives and distributors in the Los Angeles, San Francisco and Pacific Northwest areas to offer technical assistance on abrasive grain application and to discuss new barrel finishing compounds and tumbling media of the company's line. In Los Angeles he conferred with officials of Mado Products and Ducommun Metals & Supply Company, Norton distributors; and in San Francisco with *C. W. Marvader*.

Carroll McLaren, formerly owner of Santa Ana Plating Works, Santa Ana, Cal., is now a member of the Southern California sales engineering staff of Chas. F. L'Hommedieu & Sons Co., which has its headquarters in Los Angeles. A staff associate is another former job shop owner, *Earl Coffin* who, for 25 years, operated Palace Plating Co. in Los Angeles.

Glen J. Beckwith, vice-president and general manager of Metallon Products, Inc., Los Angeles, reports that Carbonic Dispensers, Inc., a subsidiary, has acquired six acres of land in the Norwalk district, 10 miles southeast

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of downtown Los Angeles, as the site for a 15,000 square foot, $200,000 factory, which will be equipped for the manufacture of ice cabinets and carbonic dispensers.

While it is planned to install facilities for metal polishing and painting in the new Norwalk plant, Beckwith disclosed that most of the metal finishing required on the products will most likely be handled in the plant of Metallon Products.

Expanded West Coast facilities for engineering and service for the line of dust control systems, blast cleaning equipment, tumbling mills and industrial ovens manufactured by W. W. Sly Mfg. Co. of Cleveland, O., have been established in the form of a new branch at 4645 East Olympic Blvd., Los Angeles. *K. G. Phillips*, formerly assistant sales manager for the firm, serves as district sales engineer.

The Bay State Co., abrasive manufacturing company of Westboro, Mass., has named *Ben Guy* of San Carlos, Cal., as its West Coast district sales engineer. Guy formerly represented the Rust-Oleum Corp., in the San Francisco Bay district.

John C. Mullarkey, formerly a Southern California contractor, has been appointed technical service representative in the Phoenix, Ariz., area for Oakite Products, Inc., manufacturers of metal treating and industrial cleaning materials. Mullarkey recently completed a training course at the firm's New York headquarters.

Southern California platers and manufacturers of plating shop electrical equipment are expected to play a prominent role in the Eighth Annual Biennial Electrical Industry Show which will be held at the Shrine Exposition Hall, Los Angeles, Cal., April 5 to 7, 1956. The exposition is being sponsored by the Electrical Maintenance Engineers Association of Southern Cal.

Donald C. Duncan, vice-president and general manager of the Helipot Corp., a division of Beckman Instruments, Inc., Fullerton, Cal., manufacturers of potentiometers, pH meters, and control instruments for electronic devices, reports that plans are underway for construction of a $2,000,000 factory at Newport Beach, Cal.

The plant will rise on a 14 acre site and will contain 150,000 square feet of floor area. The firm plans to be in production by the fall of 1956.

Manufacturers' Literature

Waste Disposal

Frederic B. Stevens, Inc., Dept. MF, Detroit 16, Mich.

The first fully automatic waste disposal system in the automobile industry for destroying cyanide and neutralizing acid-alkali waste is one of the items described in one of the group of article reprints.

Another article detailing helpful hints on cutting electroplating costs with proper waste disposal is also included.

These reprints and other bulletins on metal finishing waste disposal and metal reclamation may be obtained by writing the above company.

Rubber Coated Parts Chart

Automotive Rubber Co., Inc., Dept. MF, 12550 Beech Rd., Detroit 39, Mich.

A complete data chart on rubber insulated metal parts also describes the rubber parts produced by a process developed and pioneered by the above company. The ARco Form-Dipping process is now utilized in producing rubber parts at a reported low cost in sample lots or production runs.

The chart contains detailed illustrations of form-dipped parts in a broad variety showing diagrammed applications and complete descriptions. A full outline of the industries in which these parts serve is also given in this literature.

Rubber insulated metal parts are also extensively illustrated and described in this chart. Tables indicating die sizes and available standard design and size of grommets are also included. Applications, materials, engineering of the rubber insulated metal parts are generally described in this literature.

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0.4-1.4 pH	11.0-13.1 pH

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Distilled Water Bottle Pump

Barnstead Still & Sterilizer Co., Dept. MF, 129 Lanesville Terrace, Forest Hills, Boston 31, Mass.

Bulletin No. 136 describes how the above firm's bottle pump pumps out distilled water from tank or carboy while permitting only purified air to enter. This is accomplished by the special filter which removes and absorbs various impurities from the incoming air which replaces the liquids being drawn off.

Soda Ash

American Potash & Chem. Corp., Dept. MF, 3030 W. 6th St., Los Angeles 54, Cal.

An informational folder on Trona soda ash includes information regarding production, various grades of soda ash, distribution and other material pertaining to industrial applications.

New Bulletin on Table-Type Blast Cleaning Machine

Wheelabrator Corp., Dept. MF, Mishawaka, Ind.

A new bulletin, No. 100-D, describing one of its table-type airless blast cleaning machines has just been published by the above company. It is devoted to the Plain Table, a machine particularly designed for handling a wide range of work, like that found in job shops.

Installation views, engineering drawings, and mechanical and electrical specifications are given for all of the different sized machines. A complete discussion of the airless abrasive blast cleaning process is also included.

Finishing Stainless Steel

Frederic B. Stevens, Inc., Dept. MF, Detroit 16, Mich.

When polished and/or buffed, stainless steels have utmost corrosion resistance. However, there are also the factors of greater hardness and abrasion resistance, less thermal conductivity, and a greater coefficient of expansion. This means the type of buffs, the wheel speeds, the applied pressure of work against the buff and the compositions used are of extreme importance if the finisher is to avoid the dangers of discoloration, distortion or warping.

By making hundreds of tests and supplying reports to leading manufacturers, techniques have been developed by the above company to help cut costs and improve stainless steel finishes for many manufacturers.

Several of these reports are condensed in the new Technical Bulletin PP-124, "Successful Stevens L. V. Finishing of Stainless Steel." Finishing methods and procedures are included for cutlery, automotive moldings, cooking ware plus many other items.

This bulletin also describes how manufacturers may avail themselves of the report service at no obligation.

Battery-Operated pH Meter

Photovolt Corp., Dept. MF, 95 Madison Ave., New York 16, N. Y.

A four-page booklet has been issued by the above firm on its battery-operated pH meter, Model 125. The advantages of the model are listed, as well as a price list for electrodes, accessories and replacement parts.

Engineered Chemical Equipment

General Ceramics Corp., Dept. MF, Keasbey, N. J.

The above firm has issued a 16-page, illustrated brochure on its engineered chemical equipment. It lists five materials of construction—porcelain, stoneware, ceramic coatings, impervious graphite and alumina ceramics — the advantages of each, and its uses.

A copy of the brochure may be obtained by writing to the above address.

Wet Process Tumbling Barrels

Tumb-L-Matic, Inc., Dept. MF, 4510 Bullard Ave., New York 70, N. Y.

A new two-color bulletin, XL-55, describes and illustrates Type XL wet process tumbling barrels, which employ a compound containing abrasive materials to cut down, deburr, smooth and burnish a great variety of metal and plastic parts.

The bulletin contains recommendations for selecting specific chip media and suitable compounds to meet various finishing requirements. Detailed information is presented on barrel sizes, drives, controls, liners and optional equipment.

Two photographs illustrate models of the tumbling barrels with captions explaining the finishing operations in which they are used. A table of specifications gives standard model numbers, tumbler sizes and the number of compartments per barrel.

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10,000-20,000		.20½
20,000-30,000		.18½
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1—Bennett & O'Connell 200 ampere 6 & 12 volt. 680 RPM, separately excited. Ser. #3926.

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500/250	6/12	Optimus
750/375	6/12	Excel
940	32	Elec. Prod.
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
2000/1000	6/12	H-V-W
2500/1250	6/12	Elec. Prod.
5000/2500	6/12	Eager
5000/2500	9/18	Chandeysson

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Hammond J-34 Rotary Polishing Machine with 3-#50 7½ HP Heads.

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1—3000/1500 Ampere, 6/12 Volt, Columbia, Synch.
1—2500/1250 Ampere, 9/18 Volt, Electric Products, Synch., Exc.-in-head.
1—2000/1000 Ampere, 9/18 Volt, Electric Products.
1—1500/750 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning, Synch., Exc.-in-head.
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**500 amperes 18/24 volts Hertner.

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24000 ampere, 15 volt I-T-E silver-plated, type CR, single pole, double throw.

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Capacity to produce approximately 1000# of nickel carbonate (dry basis) per day from nickel scrap through an electrolytic process. Nickel salts so produced are used in replenishing nickel contents in plating baths.

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*1—8' L x 5' W x 9' High.
*1—4' L x 6' W x 6'6" High.

LEAD LINED & UNLINED TANKS

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*6—8' L x 5' W x 9' High, unlined.
*1—8' L x 3¼" W x 9' High, unlined.
*1—8'6" L x 4' W x 6'6" High.
*1—6' L x 4' W x 6'6" High, lead lined.
*1—15' L x 8'6" W x 9'6" H, lead lined.
*1—14' L x 10' W x 5'6" High, lead lined.
*1—15' L x 9' W x 6'6" High, unlined.
*3—20'11" L x 9'11" W x 7' H, unlined.
*1—10'9" L x 7'3" W x 7'5" High, lead lined.
*1—8'5" L x 5'11" W x 5'5" H, unlined.
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Wyandotte Chemicals Corp. 27
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Zialite Corp. 130
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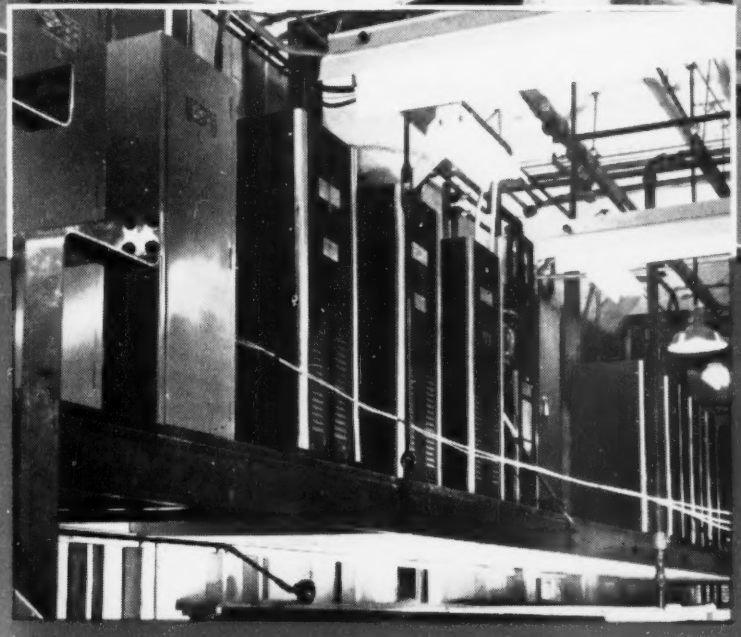

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